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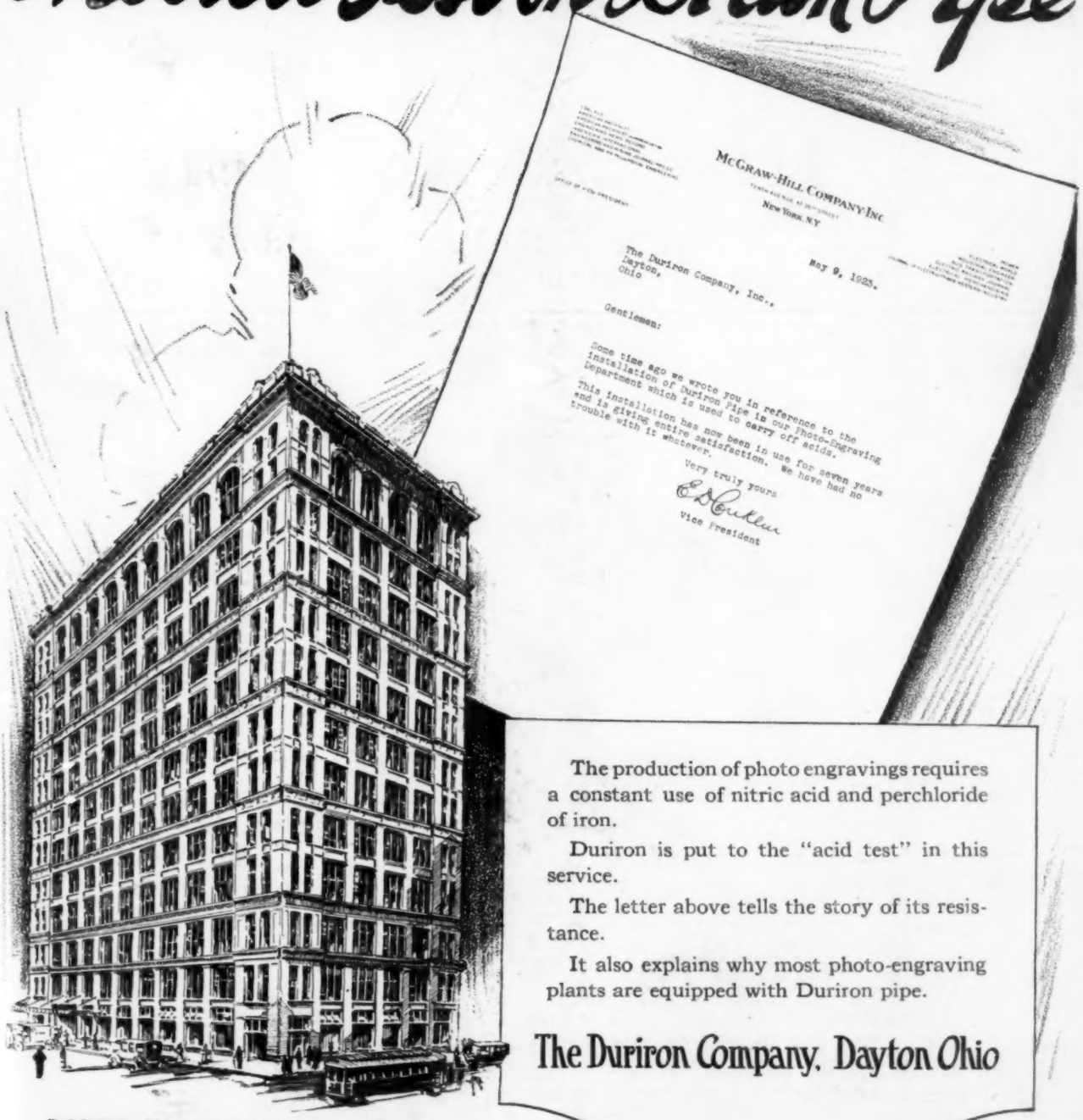
CHEMICAL & METALLURGICAL ENGINEERING

The "Acid Test" on Drain Pipe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May 9, 1923.
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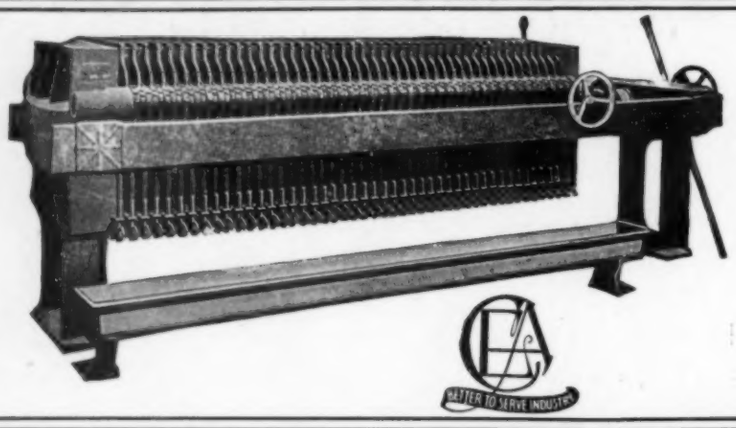

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CHEMICAL & METALLURGICAL ENGINEERING

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ELECTROCHEMICAL & METALLURGICAL INDUSTRY *and* IRON & STEEL MAGAZINE
H. C. PARMELEE, Editor

Volume 29 — New York, July 9, 1923 — *Number* 2

Keep the Patents In This Country

COMMENTING on a case on trial is treading on the dangerous ground of editorial impropriety, but we are sorely tempted to relate some of the impressions gathered in the courtroom at Wilmington as we listened in on suit in equity No. 502, United States of America, plaintiff, vs. the Chemical Foundation, Inc., defendant. Almost unconsciously we found ourselves sympathizing with Judge Morris, for it is clear that his decision is not going to be an easy one. The legal questions involved, if we understand them aright, are unusual as well as numerous. Yet so far as the chemical industry is concerned, it is our opinion that after all the immediate decision is not one of serious consequence. Conditions would be affected but little in the event of either course it is possible for the Judge to take. If the suit is dismissed and the patents remain under the control of the Chemical Foundation, they will continue to be administered in the interest of our chemical industry. Should they be handed back to the government and be held with other undistributed alien property, their effect on industry would be inconsequential.

Certain facts should not be lost sight of in connection with the real significance of these patents to the American chemical industry. Of the total of 4,800 patents originally sold to the Foundation, barely 8 per cent have been worked. In the last analysis only those relating to the manufacture of salvarsan and a few closely related pharmaceuticals have ever been put to extensive use in this country. Furthermore, as is well known to those who have endeavored to operate under these patents, their original owners possessed the very unfortunate habit of leaving out some key step in most of the important manufacturing processes. As a result the amount of research required to make these patents available to our manufacturers has been so great as in many cases to make their use entirely impracticable. Indeed some of our manufacturers have found it cheaper to begin at the beginning and to develop complete processes of their own.

The Haber patents, the bone of many a juicy contention among those whose profession is politics, are after all of no immediate and direct importance to the production of fixed nitrogen in the United States. Patents licensed by at least one American manufacturer are said to be held purely for legal protection. It is cheaper to pay the nominal license fee than to run the risk of injunction, even though the company is assured that if necessary it could prove the validity of its own basic patents. In answer to the contention that most of the patents affect our dye industry, we have the testimony that more than 90 per cent of our production of dyes is in no way dependent upon the use of Foundation patents.

The real question, and the only one of permanent significance to our chemical industry, is what is to be done with these patents in case they are to change hands. While of comparatively little direct value to the American manufacturer, still in the hands of their original German owners they might be used to the decided embarrassment of our industry. Whether these patents repose in a safety deposit vault in New York, Washington or Kalamazoo is not of particular moment, but we do feel that it is for the best interest of those who are developing a healthy American chemical industry that these controverted papers be retained in the United States. While our sympathies are distinctly with the Chemical Foundation, the question of the ownership of these patents as long as they remain in this country is by comparison insignificant. That of their ultimate disposition is paramount.

Is the National Lime Association Missing a Great Opportunity?

SEVERAL weeks ago *Chem. & Met.* published its report of the convention of the National Lime Association. Our editors were immensely impressed with the well-planned, comprehensive program of research that had been carried out during the past year. Three problems each having a vital bearing on the future health of the industry had been attacked and practically completed within the year. In addition the work on the fundamental properties of lime was vigorously pursued at the central laboratory. The program reflected credit on the members of the association for their farsightedness in supporting this research.

And now we begin to hear rumors that the association will make a drastic cut in its research appropriation, that it has definitely segregated the field work of the association from the central office which includes the research department. This latter step obviously limits the effectiveness of even the skeleton of the technical department that may remain. Perhaps if the industry had invested in an unusually sterile program of research, the policy of retrenchment and vacillation might be understood. But the technical department has brought important problems to fruition in a relatively short time—the lime partition block, quick-setting lime plaster and the use of lime in both cement and asphalt roads. In carrying out this program the active cooperation of some of the best research men in the country had been enlisted by placing National Lime Association fellowships with them. The whole program showed statesmanship of a high order.

Yet the association will not indorse the program. It has spurned a treasure. Were the damage alone to the association or to the industry that supports it, the matter would have less of our concern. But it is of more fundamental portent. Because of it trade asso-

ciation work will receive a black eye with technical men. To do good work these men must be assured of stable, continuous support. They should not have to think of next year's appropriation or the lack of it. But consequences such as are threatened by the Lime Association intimate that the technical man is insecure in association work, so insecure that he will not easily be enticed into it. And from another angle the abandonment of research would be damaging. It will indicate to other associations that the Lime Association has found research unprofitable.

Is it too late to reconsider? Is all this damage to be done because the least progressive in the industry cannot see the great benefits that come from vigorous, unified, centrally organized scientific and technical work? We most earnestly hope not.

Engineering And Politics

FOR approximately 10 years the Reclamation Service has been under the directorship of Arthur P. Davis, an eminent reclamation engineer and a former president of the American Society of Civil Engineers. Now we are to have a so-called "business man" in charge of this service through the appointment of D. W. Davis, former Governor of Idaho and incidentally a professional politician. There is no wonder that those leaders of engineering thinking in this country who make up the board of the Federated American Engineering Societies feel called upon to authorize immediately an investigation of the circumstances which have lead to the displacement of the technical director of a great engineering enterprise in the interest of another man who apparently is put in authority for purely political reasons.

Secretary Wallace of the Federated Societies has rightly appraised our interest in this matter. In explaining the position of the Federation he has said: "This procedure on the part of Secretary Work is looked upon with grave concern by the engineers and the technical men of the United States. Such summary reaction as discharging an eminently successful employee after 35 years of service without a hearing or adequate explanation and with a request to hand in his resignation to take effect within 2 weeks will undermine the morale of all of the technical agencies of the government and may lead the most competent men more readily to accept engagements with commercial and industrial agencies. If it is true, as has been reported, that certain government officials believe that a man not technically trained and fitted is more competent to handle a technical bureau than one so trained, then indeed similar action might reasonably be expected to occur in other technical branches of the service, such as the Bureau of Mines, Bureau of Standards and the Geological Survey. Members of engineering and technical bodies are not willing to believe that such a policy is a wise one and is in the best interest of the American people. Many technical directors of large works both within and without the government have ably directed such projects from a business as well as a technical point of view."

It is not yet appropriate to pass judgment upon the political aspects of this situation. These will be probed thoroughly by the committee of the Engineering Societies and unless the Secretary is willing to divulge other motives for his action, we may well await the findings of the engineers. However, the situation carries with it a significant opportunity for the engineering profession. In defending Mr. Davis' administration of this great engineering project the committee has an unusual opportunity to convince those in control of our government that the engineer by training and experience is better qualified than the business man or politician to carry on such important phases of public work.

Irrigation vs. Fertilization

INCIDENTAL mention of the Reclamation Service in our preceding comment calls to mind some frequently neglected aspects of the irrigation policy of this country. Particularly are we interested in the question as to the merit of extensive irrigation of the arid lands of the West as an economic factor in the development of the United States. There is reason to believe that this question has a significant bearing on the problems of our fertilizer industry.

One of the great costs of food products is the freight charge from the point of production to the municipal centers of consumption. A second great influence building up high cost to ultimate consumers results indirectly from the great distances of transfer, because handling over these great distances almost invariably results in the introduction of a larger number of middlemen, commission merchants and others, each of whom must take his percentage toll. Despite these facts, the United States has for years gone ahead with reclamation projects located in the arid lands of the West at great distances from the prospective market for the products from the irrigated acreage. At the present time there is due the United States Government about $130,000,000 as reimbursement from the land owners in the irrigated territory, who are expected to repay the government a portion at least of the cost of the projects installed for their benefit. Even the most ardent advocates of further development of irrigation have to admit that many, if not most, of these land holders are financially incapable of paying this debt. There can be but one logical conclusion from this—namely, much of the irrigation work that has been done by the Reclamation Service has been economically unjustified.

But one must not make too sweeping generalizations of this sort. There is ample justification for some of the federal reclamation work. There will be in the next generation or two increasing demand for the reclamation of arid lands. And there always is full justification for that parallel development of irrigation and hydro-electric power which has been very fortunately combined to give simultaneous agricultural and industrial advancement. It is equally safe to say, however, that there is much ill-advised argument for further reclamation work in certain territories. It would be very much better to have the federal government expend its money and its energies in education and assistance of existing agricultural projects rather than to go into these poorly conceived new ventures.

At the present time the Reclamation Service is spending about $8,000,000 per year on new projects. This expenditure has gone on for many years, yet there are only approximately 1,000,000 acres of irrigated land affected by federal development that are now producing crops. The value of these crops in 1919 was slightly

less than $90,000,000. In the United States as a whole there are 500,000,000 acres under cultivation, producing nearly 15 billion dollars in crop value annually. Obviously the $8,000,000 that goes into reclamation work produces a negligible percentage increase in the total acreage or total crop production of the country. All the work to date seems to have given us less than two-tenths of one per cent of our cropped area.

This same sum of money spent on investigation of methods and materials for fertilization of existing good farm land would doubtless produce a much larger percentage effect within the same period of time. It is entirely appropriate to ask whether more attention should be given to the development of intensive fertilization of all crops that lend themselves well to this treatment, rather than that we should go on indefinitely, especially under a so-called "business management," to sink money in irrigation projects that give no promise of becoming self-sufficing even in the far distant future.

Twenty-seven Cooks for The Legislative Broth

PROF. H. E. Walter of Brown University says in a recent number of *Science* (vol. 57, p. 1486) that there are twenty-seven different kinds of men. He doesn't worry about their eyes or the shape of their heads or the color of their hair; he merely records the permutations of good, medium and poor in relation to inheritance—which has to do with the quality of parents, grandparents, great-grandparents, etc.—to environment—which has to do with education and bringing up—and with responses. Or, inheritance is the actor, environment is the stage setting, and response is what the actor does in the play.

The list begins with good inheritance, good environment and good responses. Such a person is a pretty good bet. No. 14 is medium in all these. He can't change his inheritance, although he can modify his environment and his responses, within his capacity. At the bottom of the list No. 27 has poor inheritance, poor environment and poor responses.

In selecting a mate he thinks there is more hope for No. 9, who has good inheritance but poor environment and poor responses, than No. 19, who has poor inheritance but good environment and good responses. This refers to prospective progeny rather than to companionship. No one, he declares, can go all the way from the bottom of the list to the top in one lifetime. This takes generations of time and a judicious selection of grandparents.

We sometimes wonder why it is that it is so difficult to induce legislators to take a catholic view of conditions and to enact laws that are effective for permanent benefit. Analysis would show that a large number of legislators are of medium or poor inheritance, because the self-made man, no matter how little he may have made of himself, usually has a distinct advantage at the polls over one with good inheritance. The vast majority of voters are of poor inheritance and they like their own kind. The reasoning process is, "If he is like me and feels as I do, then he will want the things that I do and work for them." But the poor galoot who reasons this way has not imagination enough to want anything more than high wages.

In regard to the environment of a large number of legislators, it is of their own choosing, and this is the Public Eye. Now the Public Eye is not a good place for one's best work. There's too much noise, and whoever is looking for applause must compromise with his conscience to get it. The public is as often wrong as it is right in its notions, and righteousness has nothing to do with public opinion. The good man does right in spite of public opinion. This requires character, and for the strength of purpose to support character we need grandparents.

In responses the politician is unusually rich. There he shines. Talk is his *métier*. He doesn't reason, but he *can* talk. And that is the pity of it. Talk is about the worst nuisance in civilization, unless one says something. Well, just read the *Congressional Record!* That tells the whole story. Poor inheritance, the environment of vanity, and easy, oily responses. No wonder we have trouble both at home and abroad from the enactments of our legislative solons.

Education a Factor In Fertilizer Sales

IF ALL GOES WELL with the crops this year, the agricultural community will soon have a greater buying power than it has enjoyed at any time for several years past. This gives promise of greater opportunity for the fertilizer industry. But to realize upon this opportunity it will be necessary to bring to bear more strongly than ever the influence of cold facts upon propective purchasers. They have got somewhat out of the habit of buying and it will take more than the usual effort to get them back. A prodigious attempt must be made by the fertilizer industry to show the farmers and farm organization representatives throughout the country that in general the return of increased crop values will be several times the cost of the fertilizer.

The soil improvement committee of the National Fertilizer Association has received good support from the industry during recent years. It has been recognized that this committee could bring together, coordinate and redistribute all of the valuable work being done in the country by federal and state officials interested in fertilizer tests, soil improvement work and crop cultural methods. And there has never been a time when the industry needed this service more than in the very immediate future. It is to be regretted, therefore, that the fertilizer manufacturers have not seen their way clear to increase the funds available for this work as was recommended by those who studied the problem most intimately and who understand the latent possibilities of this endeavor. As a consequence, approximately $75,000 will have to serve for another year for this work instead of $100,000 that was requested.

This committee serves as a most valuable agent in digesting information gathered from a multitude of sources so that it will be most readily useful to farmer, county agent and agricultural salesman. Without this intermediary between the investigators and the users of research results, much of the value of the research is lost simply for want of means of communication and for want of understanding of the facts. It is certainly to be hoped that this, one of the most valuable agencies in the selling program of the fertilizer industry, may soon be given the encouragement and increased support needed for the most effective prosecution of its educational work.

A New Idea in Purchasing Efficiency

A Message to Advertising Men That Reveals a Real Responsibility on the Part of the Engineer—a Responsibility to Purchase Intelligently

YEARS and years ago when commerce was young, there was a prevalent slogan that reflected little credit on the then existing business morality. Caveat emptor! Let the buyer beware! This has changed completely, whether due to John Wanamaker and the "one-price" idea, or to the ultimate triumph of "honesty is the best policy," or to the progressive sales manager whose individual efforts may have leavened all of business. Whatever the cause, the sales manager of today insists that the buyer shall have what he wants. He has gone farther than that. He has spread before the buyer an infinitely wide choice of materials and products and he has encouraged the buyer to make selection where any one of a dozen varieties might be satisfactory.

It is easy and flatteringly pleasant for the buyer to demand and get an axe of a slightly different shape, a pipe wrench with a small dimensional difference, and other "specials" for his consumption alone. It gives him a feeling of importance. And speaking of axes, behold those offered by three manufacturers—thirty-four models in one to four grades in from one to thirty-five brands, from one to eleven finishes, and from five to nineteen sizes—actually 6,118 different axes, and if you really insisted you could probably get any one of the thirty-four models in any of the four grades in any of the thirty-five brands in any of the eleven finishes in any of the nineteen sizes, making a total of 994,840 different axes.

Well, what harm? you ask. Not much originally, for it got the business for the progressive sales manager; but now, because it has become universal and has brought with at an enormous economic loss, it is harmful. Instead of one or a dozen varieties a manufacturer makes a dozen or a hundred, and this multiplicity increases production costs and ties up unbelievable amounts of capital in keeping the many varieties in stock. No production man needs to be told that it is cheaper to make one standard thing than to make a dozen variations of it, and it is simple arithmetic to show that to stock twelve products will produce from five to twelve times as much frozen capital as a single product. Actually the president of a large farm implement manufacturing company estimated a saving of $10,000,000 to that industry in 1920 due to the partial elimination of these two factors.

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Frederick M. Feiker

Special Assistant to the Secretary of Commerce and a former vice-president of the McGraw-Hill Co. For a long time a leader in modern journalism, whose message to the advertising men is interpreted for the engineer.

This is part of the significance attached to Secretary Hoover's campaign of simplified practice. He created a division in the Department of Commerce 2 years ago to act as a center point to which all parties to a trade could come for common discussion of the questions of eliminating wasteful practices of that trade, especially with regard to simplifying lines of commodities and eliminating of excess styles. "Standardization" became the war cry. The movement was christened by engineers who understood the word, but it awoke suspicion in the breasts of the uninitiated and they visualized an abolition of individualism and self-expression. Standardization meant colorless uniformity to them and the subject furnished much gist for the cartoonist's pen. This by way of parenthesis, for it does not need to be stressed to an audience of engineers that standardization is a thoroughly common sense measure that will gain full advantage of interchangeability, mass production, reduced stocks, quick turnover, and high-quality product for American industry.

But this great economic saving will be wiped out completely if the buyer insists on sizes and styles that have been discontinued. No matter how unanimously a group of producers agrees to eliminate a given variety, it will come back if only four or five buyers demand it. The important thing is, therefore, to sell the buyers on this fundamental idea and sell them fast.

Thus Mr. Feiker challenges the men of the Associated Advertising Clubs of the World, whom he was addressing at their Atlantic City convention, to teach the buyer to demand what he needs, not what he thinks he wants. This is the new task for advertising, and by that same token it indicates a new responsibility for the buyer, and especially for the technical buyer, the engineer. Educate yourselves so that you and the industrial community may benefit by decreased production costs. Buy with intelligence and with a thought for industry as a whole. Contribute your share to the solution of this perplexing problem.

This message of Feiker's deserves your thoughtful consideration. It is not a subject that raises our enthusiasm to a point compelling momentary action and thus accomplishing the end. It is one of those problems that we must face daily and in the intelligent decisions on comparative minutiæ help to diminish a great economic loss. We must be alert to the play of the economic forces in the routine of business.

Kelp products plant at Summerland, Calif.

Kelp harvester

Potash From Seaweed in California

Brief History of the Kelp Industry—Introduction of Refinements in Processing—Practice in Scotland and California—Prospects of Rehabilitating the Industry

BY A. W. ALLEN
Assistant Editor, *Chem. & Met.*

EARLY last century, Scotland was producing about 20,000 tons of potash and byproduct salts per annum from the treatment of seaweed. Crude methods were employed, involving atmospheric drying, burning with heather, lixiviating the ash in open vats, evaporation of the resultant liquor in pans and selective crystallization of potash and "kelp salt," as the byproduct was termed. About the middle of the nineteenth century, several plants were erected in Scotland to treat the kelp by more scientific methods, in closed retorts, so that additional byproducts, such as ammonia and iodine, might be recovered. The encroachments of German potash and the growth of the Chilean nitrate industry, which produced iodine as a byproduct at a negligible cost, were jointly responsible for the economic failure of the ventures.

Progress in the treatment of kelp in the United States during recent years has followed along the same lines, although the industry was initiated here at a much later date. The kelp industry was inaugurated in the United States 10 years ago, when two companies were organized to harvest and dry kelp. Concurrently an attempt was made to burn a proportion of the raw product in a reverberatory furnace and to leach the ash with water; but failure resulted, partly because of the limited scope of operations and partly because of technical and mechanical difficulties.

Subsequent attempt was made at Long Beach to employ kelp for the manufacture of potash and iodine and at the same time utilize the organic part of the kelp in the manufacture of plastics. The utter lack of consideration of established chemical engineering principles resulted in the early termination of these efforts without any demonstration of the commercial feasibility of the project. A measure of success, however, crowned the efforts of one of the large packing houses to operate a plant at San Diego during the war, for the preparation of a crude dried product, which was shipped East to form the basis of fertilizer compounds. One of the leading match companies also entered the field, with what technical or economic result is difficult to determine. In this connection it is interesting to note that Japan is said to produce from kelp her domestic requirements in potash salts and it is known that she exports considerable quantities of iodine manufactured from this raw material.

The most significant advance in the utilization of kelp as a raw material for the production of chemical compounds was due to the work of the Hercules Powder Co. to meet war-time demands from Great Britain for a supply of acetone. During 1917 an average of about 24,000 tons per month of kelp was handled in an immense plant that had been erected in San Diego, Calif. It was demonstrated that the cutting of the weed accelerated top growth, and that harvesting over the same area was practicable every 3 months or so. A fleet of harvesters, barges and tugs was put in commission. The significant feature of the harvester vessel used was the provision of macerators and mills on board, whereby the weed was ground to a pulp as it was delivered to the vessel, to be pumped subsequently to the barge alongside. Cheap transference was made possible by the use of a rotary type of pump developed by the Goulds Mfg. Co. After being towed to the wharf by tug, the chopped kelp, together with the released liquor, was pumped to fermentation vats. Liming was followed by vacuum filtration, the solid residue being discarded. The liquor resulting was treated in evaporators, producing calcium salts of the fatty acids, which were made into high-grade solvents, calcium acetate, which was made into acetone, the principal product of the plant, iodine, potash and a long series of fatty acid derivatives and some highly interesting plastics.

Concurrently, but farther north, at Summerland, near Santa Barbara, smaller operations were being carried on by a company that was harvesting the weed in the

Unloading the kelp

same manner as at San Diego, but chopping it after it had been removed to the wharf by grab bucket. From bins it was fed automatically to revolving driers, and thence to incinerators of the same type, all of which were oil fired. After cooling to atmospheric temperature, the product was sacked for shipment.

The potentialities of the kelp industry in California may be gaged from the fact that 400,000 tons of the raw material was harvested in 9 months in 1918. Governmental interest in the possibility of recovering potash and byproducts from seaweed crystallized in 1916, during the period of national emergency caused by the war. Congress voted two appropriations, totaling more than $300,000, for the erection of an experimental plant and to enable research to be carried out. A site was chosen at Summerland, Calif., and construction was commenced in March, 1917. Rapid progress was made, with the result that operations were begun in August of the same year. It was proposed to treat about 100 tons of the raw material per 24 hours, which was to be harvested by the type of mower previously found successful at Summerland and elsewhere in California, chopped, dried and treated for the recovery of ammonia, potash, iodine, decolorizing charcoal (called kelpchar) and other byproducts.

Two twin-screw power boats were equipped with mowing blades of reciprocating knives, with which a broad channel was cut in the seaweed a few feet below the surface of the water. As detached, the kelp was taken up to the deck of the harvester by means of a draper conveyor and dumped into the hold of the vessel. At the wharf the seaweed was transferred by means of a clam-shell fork to the hopper of a machine equipped with revolving knife blades, similar to that used to chop ensilage, and designed to reduce the length of individual pieces to about 6 in. From here it was carried by drag conveyor to one of two storage bins, the juice that oozed from the weed acting as an efficient lubricant.

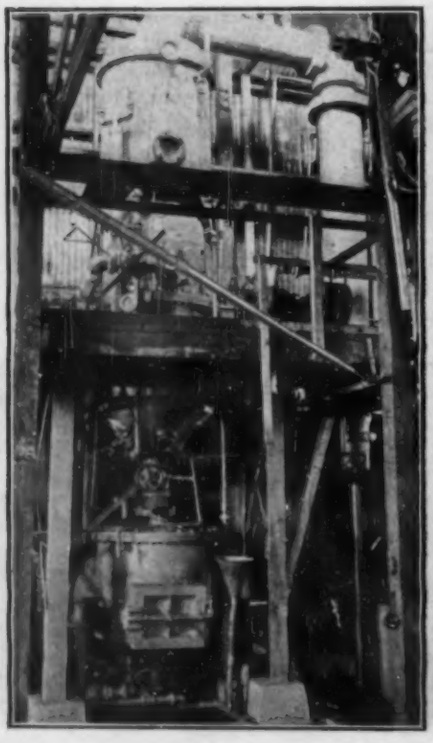
The storage bins were filled alternately, thus permitting the drainage of juice, the expression of which was hastened by the weight of the mass. This juice, which contained a proportionate amount of the soluble constituents of the seaweed, passed direct to the plant. The chopped kelp, after draining, was delivered by drag conveyor and divided between two revolving driers, equipped with baffles to insure the breaking up of the mass as it passed through the cylinder toward the exit, where the heat was applied by means of oil burners, in conjunction with gas liberated at a subsequent step in the process. After passing through the primary driers, the material was combined in one stream and the treatment was finished in a third drier.

Retorting practice at first consisted of passing the dried kelp through four vertical 12-in. clay tubes, each nearly 20 ft. long, which were heated externally. The method adopted included the provision of a vacuum, whereby the gases evolved were drawn off, and from which tars, oils and creosote were recovered. Subsequent research indicated the necessity for the more complete "activation" of the char preparatory to the extraction of potash. A special type of vertical retort was evolved, the product from which was treated in a homemade electric furnace.

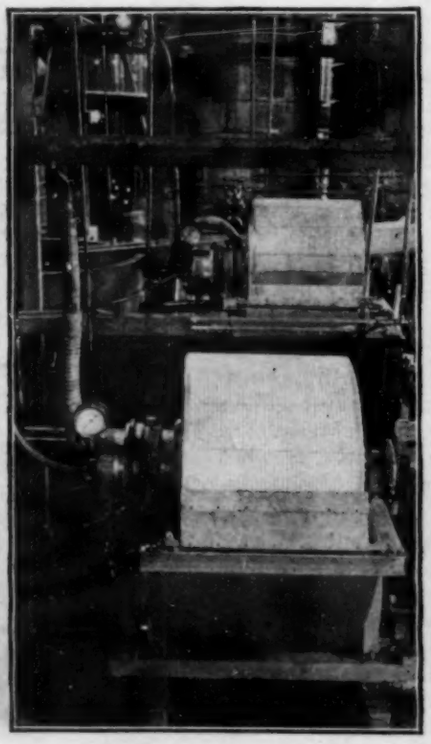
Extraction of the Potash

The retorted char was treated counter-currently by an ingenious scheme of vacuum filtration and repulping with weak solution and, finally, water, devised by Dr. J. W. Turrentine, who was in charge of the research. Oliver and American disk filters were used. The final insoluble cake was dried and sacked for shipment and sale as a decolorizer.

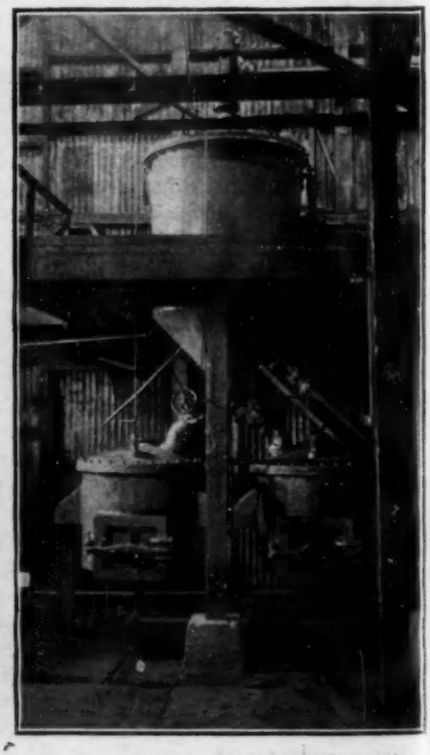
The high-concentration liquor from the first vacuum filter was rectified, and various impurities removed so far as possible. The resultant liquor was sent to a vacuum evaporator and concentrated to a point of saturation in respect to potassium chloride, then transferred



Evaporator



Oliver filter used for washing kelpchar.



Crystallizer with twin salt baskets.

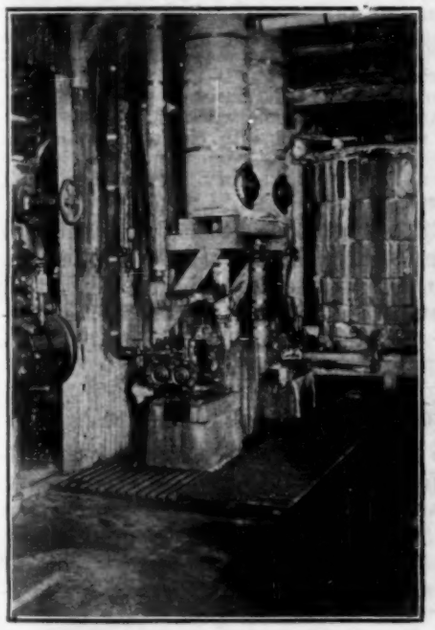
by vacuum to a vacuum crystallizer to effect the precipitation of that salt, which was deposited in twin salt baskets, the remaining liquor passing back to the evaporator, equipped with a salt basket in which the sodium chloride was removed. The process was repeated in continuous operation until the mother liquor contained sufficient iodine to justify recovery treatment. Calcium hypochlorite and hydrochloric acid were used to effect the precipitation, the iodine in the resultant crude product being distilled. The recovered salt and potash were wrung in a centrifuge, dried in a rotary drier and sacked for shipment.

The plant at Summerland passed into the hands of private interests early in 1922. Minor changes were made, and the equipment was overhauled and operations were continued for several months. Work is now suspended, pending arrangements for re-financing.

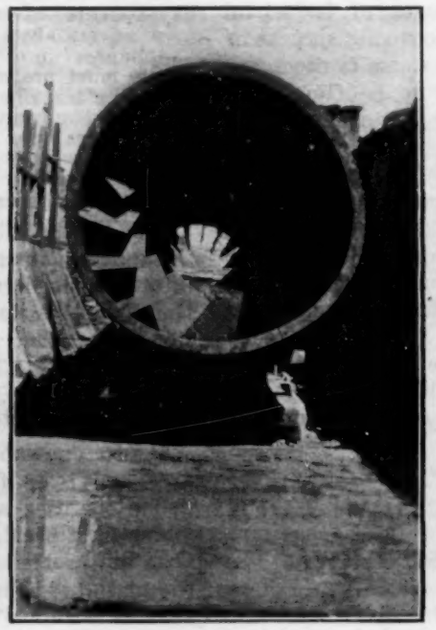
so that a gravity fall is available, might be considered advisable, in place of the reverse arrangement, as at present. The advantages of the change might more than counterbalance the extra cost involved by the elevation of the material, which contains a considerable percentage of water and is therefore heavy.

The fact that the Hercules plant at San Diego is idle is no evidence that commercial possibilities do not exist for the manufacture of fermentation products from seaweed. The acetone market has been strong of late, and no plan for the commercial utilization of kelp would be complete unless due regard were paid to the potentialities of the acetone industry.

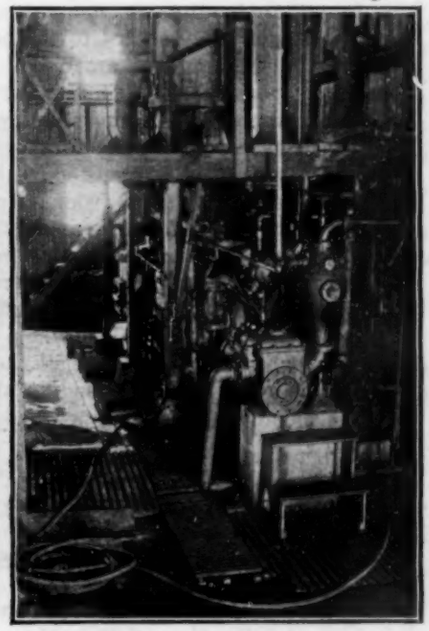
A feature of the operations at San Diego was the chopping of the kelp on the harvester to such a size that pumping was practicable. This proved a rapid and cheap method of conveyance of the raw material to the



Compressor and vacuum pump



Interior of rotary kelp drier.



Pumps and evaporators.

Sufficient work has been done to demonstrate the practicability of the process as developed by Dr. Turrentine and his colleagues, particularly in regard to the system of counter-current char treatment with vacuum filters. It is also worthy of note that a complete and detailed description of the technology of the process has appeared from time to time in the form of monographs in *Industrial & Engineering Chemistry*, written by Dr. Turrentine in collaboration with H. G. Tanner and P. S. Shoaff. These constitute a valuable library of reference on the subject. It remains to discuss the economic applications of the results obtained to date. Further research may be considered necessary to determine the most economical method for the satisfactory incineration of the char, preferably in one operation.

In the first place, the point must not be overlooked that the plant at Summerland was erected for experimental and research purposes during a period of national emergency. An attempt to make it meet industrial competition in peace time is unlikely to be successful unless radical changes are made to insure continuity of operation at a reasonable cost on a sufficiently large scale. Maximum-scale operation is desirable to insure low overhead expense. The conveyance of the seaweed to the top of the plant in the first instance, plant. It would be interesting to know what conclusions, if any, have been reached as to the economic practicability of separating roughly the chopped product from the liquor that oozes from the weed, and treating each separately, the former primarily for the production of charcoal and potash, and the latter for acetone and potash. Iodine, of course, would come from both. The production of other byproducts might also be profitable.

Technology without economics is doomed to failure. No stable market can be expected until the products of a plant are of standard grade and quality, and until a steady supply is available, with no reason to expect the discontinuance of operations. Technicians on the staffs of industrial companies are chary about recommending a substitute, in place of a decolorizer that has proved satisfactory, especially if the supply of the new product is likely to be intermittent. To be successful, the kelp industry must be operated on a commercial basis, for experimentation is incompatible with sustained output. If kelp char is to displace other well-known decolorizing and adsorbent agents, it must be obtained when and as required. The supply must be steady. The quality must be better or the cost must be lower than any other product on the market; if both

factors are favorable, so much the better. This implies a regular output and operation on a commercial basis.

Work to date has demonstrated the commercial possibilities of kelpchar. Apart from its application as a decolorizer, it has proved an extraordinarily satisfactory precipitant of gold in the solutions resulting from the cyanide process; but here again, no commercial application can be expected unless supply is guaranteed and opposition to substitutes in place of existing precipitants is overcome. Further, the scope of kelpchar as a precipitant of precious metal thus is admittedly limited, although a similar product, made from wood, has been used successfully in Australia for several years. The value of kelpchar as a precipitant of gold in place of metallic shavings or dust depends largely on the fact that the action is physical and not chemical, and no fouling compounds are introduced into the working solution.

"United we stand, divided we fall" is a motto that has found application in many phases of industrial work, particularly in regard to the economic success of a process in which a large amount of steam is necessary to effect evaporation. Salt brine, *per se*, is often valueless as a raw material; but industry has demonstrated how the cost of operating a lumber mill, for example, can be reduced if it is credited with the value of the heat in the exhaust steam from its power plant, which in many instances is used near by for the evaporation of the water in the brine, the low cost of the exhaust steam permitting profitable operation at the salt-making plant. It has been suggested that sufficient steam would be available to operate a large kelp products plant, to insure the cheap operation of all the evaporators; but it would be wise to look ahead in this respect and to consider the advantages of a new industry alongside.

Interpretation of the New York Engineers License Law

Some Confusion Has Existed in Regard to the Application of This New Statute

THE New York engineers license law will take effect Aug. 1, 1923, and every engineer who has not applied for a license and whose work is such as to require a professional engineer's license is urged to make application without delay, as the law may be interpreted to apply to everybody doing engineering work which may be deemed "responsible," or any person not licensed on or before May 1, 1923 (later changed to Aug. 1, 1923), who publicly calls himself an engineer is liable, upon trial and conviction, to fine or imprisonment or both.

The American Institute of Electrical Engineers has had a committee at work upon this legislation and it has prepared the following statement of its understanding of this law:

An engineer who has (or offers from an office in the state to take) charge of engineering work for a client, or as a salaried employee, must be licensed if this work involves "the planning, designing, construction, inspection and supervising of engineering work, or appliances involved in public or private projects, or in making investigations for proposed engineering projects."

The technical head of the engineering department of any manufacturer of "appliances involved in public or private projects" and the engineer who "supervises" the operation of the engineering branch of a public utility must be licensed just as much as the engineer engaged in consulting practice. If the principal engineer has a deputy who has full responsible charge in the principal's absence, the deputy must be licensed. An operating engineer of a power plant holding an operating engineer's license issued under other laws of the state does not have to be licensed under the professional engineer licensing law in order to continue his engagement as an operating engineer.

An engineer who neither resides nor has an office in New York State may, without taking out a New York license, offer to do engineering work in the state and actually do such work there for not more than 30 days in a calendar year if he is legally qualified as an engineer in his own state.

If a manufacturer sells a product which his men erect in the field by methods not involving engineering skill and knowledge, the erectors need not be licensed. But if the manufacturer furnishes, in addition to his own products, plans for structures not made in his shops and calling for more than the ordinary skill of a skilled workman to execute, such plans must be made by a licensed engineer and the field work must be supervised by a licensed engineer.

Salesmen employed by manufacturers, who give advice to customers on "planning, construction, inspecting and supervising of engineering work or appliances" other than those produced by the manufacturer, must be licensed as professional engineers.

Engineers employed in "service departments" or "trouble departments" of manufacturers of "appliances," who must give advice about other engineering matters than those "appliances" in order that the latter may function satisfactorily, must probably be licensed. It is often difficult to fix the place where skilled craftsmanship ends and professional engineering begins, in the work of these men.

Engineers who may be called into court to testify as engineers will doubtless find the possession of a license helpful in qualifying, even though they are not compelled by law to be licensed.

This license will cost the applicant $25, to be sent with the application, and $1 annual renewal fee. For detailed information, license forms, etc., apply to Herbert J. Hamilton, Assistant in Charge of Professional Examinations, State Education Building, Albany, N. Y.

Characteristics and Uses of Slate*

Before one can properly establish a system of standards and tests for any mineral commodity, he must define its uses and clearly understand the properties which fit it peculiarly for each use. It is essential also that the problems of the producer as well as those of the consumer be taken into account, for thus wise utilization is attained and economical production is safeguarded.

Composition and Properties—High temperature and intense pressure involved in the process of slate formation converted the original clay into other minerals, such as quartz, mica and chlorite. It is important to note that while slates are formed from clay rocks, the best commercial slates contain very little clay. Dale, of the U. S. Geological Survey, gives the following approximate composition of average quality slate:

Mineral	Per Cent	Mineral	Per Cent
Mica (sericite)	38 to 40	Hematite	3 to 6
Chlorite	6 to 18	Rutile	1 to 1½
Quartz	31 to 45		

It may be observed that no mention is made of a clay content.

Slate is of medium hardness, very fine grained, of low porosity, great strength and consists essentially of minerals that are very stable and resistant to weathering. The chief colors are gray, black, green, red, purple and mottled.

Uses—A folder recently issued by the National Slate Association lists about sixty uses for slate, the chief of which are roofing, electrical switchboards, blackboards, and structural materials such as steps, toilet inclosures, shower stalls and baseboards.

*Extracts from a paper by Oliver Bowles of the Bureau of Mines, read before the meeting of the American Society for Testing Materials, Atlantic City, June 29, 1923.

Operating Practice in Refining Cracked Petroleum Distillates

How the Sulphuric-Acid and Sodium Plumbite Treatments Are Modified to Handle Products of Cracking Processes

By Gustav Egloff and Jacque C. Morrell
Universal Oil Products Co., Chicago, Ill.

During 1923 there will be produced approximately 2,100,000,000 gal. of cracked gasoline, passing commercial tests for use in automotive engines. This quantity of cracked gasoline will have been refined by means of sulphuric acid. To refine 2,100,000,000 gal. of cracked gasoline approximately 125,000 tons of sulphuric acid will be required. To neutralize the excess of sulphuric acid and the organic acids, 75,000 tons of caustic soda will be needed. To remove the sulphur compound in the cracked oil sufficiently to pass commercial inspection, 12,000 tons of litharge and 9,000 tons of flowers of sulphur will be used by the petroleum industry during 1923 to market over two billion gallons of cracked gasoline.

The idea is prevalent that cracked hydrocarbon oils are not amenable to treatment by the ordinary method now used for treating straight-run distillate. This is not the case, however, and the authors have been able to demonstrate that the refining of cracked distillate requires simply a special modification of the method used for refining light oils in general. Bearing in mind the differences in composition between cracked and straight-run oils, it is possible by a reasonable change of the sulphuric-acid treatment to obtain water-white gasoline of sweet odor, passing all specifications.

Mechanical Arrangement for Treating

The ordinary sulphuric-acid treatment, where no sulphur compounds are present in the cracked hydrocarbon oils, consists simply in agitating the oil with the acid, either by mechanical means or by means of air agitation; water washing the resulting oil after allowing the sludge to settle, and taking off the sludge. The oil is then agitated with caustic soda, washing with water before and after, and finally distilling, usually in the presence of steam, direct fire, or both.

However, where sulphur compounds are present, additional treatment must be applied, as will be referred to later.

The actual mechanical arrangement for the treating of petroleum distillate may be grouped under two headings—batch treatment and continuous treatment. For the former, the agitation is carried on in vertical cylindrical tanks with conical bottoms. In most cases the agitators are lead lined, the thickness of the lead being from $\frac{3}{16}$ to $\frac{1}{4}$ in.

Regarding the method of mixing for agitation, the three following processes in general use are followed: (1) Mechanically driven paddles; (2) the use of circulating pumps, usually taking suction at the top of the agitators and bringing oil in at the bottom, and (3) agitation by compressed air. The last method is the one in common use at the present time, although the losses involved in its use are very high. An improvement is the use of an inclosed agitator, making use of a blower to circulate air or flue gas for agitation. The loss by evaporation is very greatly diminished by this method.

The agitators are usually emptied through a three-way branch pipe, provided with large openings to allow the passage of material after the valves have been suitably adjusted. The sludge acid or alkali and oil are thus carried to their proper receptacles. Water washing is usually effected by sprinkling the water through the oil with a sprinkling arrangement at the top of the agitators. The washing is continued until the outgoing water gives only a slightly acid reaction.

In continuous refining, a great many different systems have been devised. One that is feasible is operated as follows: The distillate to be treated is pumped into a series of tanks containing acid. The oil is introduced at the top of the tank, the latter being closed on the top with an outlet valve to take care of excess pressure. The oil is overflowed from one tank and passes through the acid at the bottom of a second tank. Three such tanks are used. One method that is generally preferable is to pump the oil and the acid, properly proportioned, through the mixing coil and from there into an acid-mixing and acid-settling tank. The oil finally overflows into a wash tank, where water is stirred down through the oil and is drawn off at the bottom. From this tank the oil overflows into a tank containing caustic soda solution, usually filled to about one-half of its capacity. From this tank it flows into another washer and then into a settling tank, and then finally distilled.

Variable Conditions of Acid Treatment

Although various strengths of sulphuric acid as low as 63 deg. Bé. (83.3 per cent) will give a very good product and good results may be obtained in some cases with fuming sulphuric acid, it has been found advisable for several reasons to use 66 deg. Bé. acid (95 per cent, sp.gr. 1.84). One of the reasons for this is the fact that ordinary commercial sulphuric acid is shipped in this form. Furthermore there is less chance for equipment being attacked by this strength.

The quantity of acid used in treating cracked hydrocarbon oils varies from 1 to 7 lb. per barrel of the distillate. It has been found good practice to apply the acid in several applications, the reasons for this being apparent. The heating effect, due to the reaction of a large quantity of acid, is much greater than when the same quantity is applied in several applications; furthermore, better results have been obtained by this method.

The refining power of the acid is not proportional to the quantity used. If too great quantity of acid is used with cracked distillates, the latter are apt to become fixed in color, or to be "burnt," to use a refinery term. The range is quite wide, however, and a preliminary trial will determine the approximate quantity necessary. For example, a pressure distillate which required only $1\frac{1}{2}$ lb. sulphuric acid per barrel was found to give good results with 6 lb. per barrel. Where fuming sulphuric acid is used in the treatment of cracked distillate (and it may be pointed out that in the experience of the authors it is never required), about one-fifth less acid is required as compared with the 66 deg. Bé. acid. The losses are, however, correspondingly high with the fuming sulphuric acid.

Removal of Sulphur Compounds

For the removal of certain types of sulphur compounds, it is general practice to make use of a solution of litharge and caustic soda, thus producing sodium plumbite. The amounts used vary from 4 to 10 lb.

litharge per 100 bbl. of oil (125 to 150 lb. litharge dissolved in 400 to 500 gal. of 12 to 30 deg. Bé. caustic soda for 1,400 bbl. of oil). For oils containing a high percentage of sulphur, a larger amount is used; up to 10 per cent by volume of the oil is not uncommon. The excess material can, of course, be recovered. The best practice has been to make up a solution in a separate tank, using a slight excess of litharge over the amount that will go into the solution.

The practice in this respect varies considerably. In some refineries the oil to be treated is agitated with caustic soda and the litharge is added while agitating. This plainly entails an enormous loss of litharge in addition to preventing its efficient solution in the caustic soda. The reason for this is apparent. The passage of the litharge through the oil that is being treated causes it to be wetted by the latter, thus preventing its effective solution in the sodium hydroxide. The excess litharge, whether introduced in this manner or in any other manner (e.g., suspended in the NaOH), becomes mixed with the lead sulphide and other reaction products as well as the flowers of sulphur, sometimes added later as a precipitating agent in the case of straight-run distillates. These impurities render the litharge practically unfit for further use.

The solution of litharge in caustic soda is pumped into the agitator containing the oil and vigorously agitated by means of the air current for about 40 to 50 minutes. Since the excess plumbite solution may always be recovered by settling out the impurities, it is always advisable to use an excess in this treatment. It is to be noted that for cracked distillates the plumbite treatment as well as other chemical treatment is always given prior to distillation.

In the treatment of cracked distillates it is not advisable to add sulphur at any stage after the acid treatment, because sulphur or some of its compounds will remain dissolved in the oil. This is especially true, of course, if the oil is treated with plumbite solution after distillation, as is the practice with straight-run distillates. In the case of oil such as cracked distillates from Mexican oils, which cannot be treated by the above method, the plumbite treatment is given before the acid treatment, in which case a small amount of sulphur may be added without injurious effects.

Suggested Scheme of Treatment

Investigation by the authors has demonstrated that best results can be obtained in the refining of cracked distillates if the following order of treatment is followed:

I. For oils which do not contain a considerable amount of sulphur, such as pressure distillates from charging stocks of mid-continent origin:

(*a*) Application of 66 deg. Bé. sulphuric acid in several doses.

(*b*) A thorough washing with water (the greater the number of washes the less amount of caustic needed in the subsequent step).

(*c*) Caustic wash followed by a water wash.

(*d*) The distillation with steam, preferably introducing the steam into the body of the oil. The steam distillation may be assisted by a low fire.

The keeping qualities of gasoline so treated will be improved if the final water wash is followed by a wash with a small amount of sodium plumbite solution and then a final water wash before steam distillation.

II. Where the oil contains sulphur compounds—for example, pressure distillates of Mexican or Californian origin—the above scheme is followed except that a larger amount of sodium plumbite is used. This method is one that can be most generally applied to cracked distillates. No sulphur is added and it is recommended that its use be abolished in treating cracked distillates except as mentioned in III.

III. In the very few exceptional cases where the above treatment failed to give water-white gasoline of sweet odor, a heavy plumbite treatment is given *previous* to the sulphuric-acid treatment, in which case a very small amount of sulphur is added as a precipitating agent. The distillate is then washed with water, acid treated, washed again with water and finally steam distilled.

IV. Blending cracked distillates with straight-run light distillates increases the ease with which the former may be treated. In some cases it may be advisable, though not as economical, to acid-treat the cracked distillates, water-wash and neutralize, steam-distill and then blend with straight-run gasoline for sweeting. The cracked distillate, however, may be more economically treated alone or blended with the benzine cut from straight-run material and treated preferably as under II.

It is strongly recommended that cracked distillates be treated by continuous methods, thus cutting down the evaporation losses attending batch methods. It is possible to use batch methods with resulting low losses in a closed agitator, making use of a blower system for agitation, although the results will never be as desirable as with a continuous system.

Investigation of Orifice Gas Meters

For several months the Bureau of Standards has had under way the preliminary arrangements for an investigation of the performance of orifice meters. Certain special equipment, such as large-size air compressors, cooling coils, receivers, test lines (made of extra heavy piping), besides indicating instruments, is necessary to carry out work of this character, and it has been largely because of the excellent facilities offered to the Bureau of Standards by the War Department at Edgewood Arsenal, Edgewood, Md., that the taking up of this investigation has been possible. The present investigation has been limited to a study of the orifice meter of the type used in the commercial measuring of gas. The principal problem of the investigation is to determine the discharge coefficient under all the variable circumstances that may occur within the range of commercial or engineering practice.

To solve this problem it will be necessary to make a careful study of the effect of the following variables upon the discharge coefficient: (1) The shape of the orifice, which may vary from a sharp-edged hole in a thin diaphragm to a long flow nozzle; (2) the diameters of the pipe and orifice—i.e., the size and area ratio of the orifice; (3) the location, size and finish of the pressure taps; (4) the length of straight pipe on each side of the orifice or the nature of the fitting or obstructions near the orifice; (5) the linear speed through the orifice or the rate of flow; (6) the absolute pressure in the line and the magnitude of the differential; (7) the density, viscosity and specific heat ratio of the gas and its deviation from Boyle's law; and (8) steadiness or pulsation of the flow.

The set-up, as now arranged, will permit the study with air of points 1 to 6, as enumerated above, through a wide range of conditions. It may also be possible to give special attention to item 8. It is hoped that when this work is completed it will be possible to make experiments using natural gas or other gases for the investigation of point 7.

Up to the present time only a few preliminary runs have been made. During these runs approximate checks were made of the discharge coefficients of the flow nozzles which are to be used in the final measurement. These runs have also shown defects in the equipment.

Vitreous Enameling In the Electric Furnace

By J. L. McK. Yardley
General Engineer, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

In the Manufacture of Vitreous Enameled Ware, Whether of Cast Iron, Sheet Iron or Sheet Steel, the Method of Firing Has a Most Important Influence Upon the Cost of Production. This Article Discusses the Types of Furnaces That Have Been Developed to Fire Vitreous Enamels More Efficiently Than the Old Clay Muffle, Including Operating and Cost Data on Some Recent Installations of Electric Furnaces for Various Classes of Service in This Industry.

FOR MANY YEARS the vitreous enameling of cast-iron sanitary and domestic ware, sheet-steel and sheet-iron ware, ornamental and art wares has been carried on in kilns or furnaces of clay-muffle type, fired with oil, gas or coal. Large quantities of excellent products have been manufactured and total rejections have probably been only from 1 or 2 per cent to 7 or 8 per cent, depending upon the size and class of ware. Chemical engineers have, however, been actively studying various means to reduce rejections, improve the product and cut the over-all operation cost. Prevention of contamination of the enamel through products of combustion has been one of the chief problems, both in the preparation and in the application of the enamels. Together with proper temperature, requisite amount and distribution of heat, life of refractories and operating cost, prevention of contamination has been a principal consideration in all furnace developments in this industry.

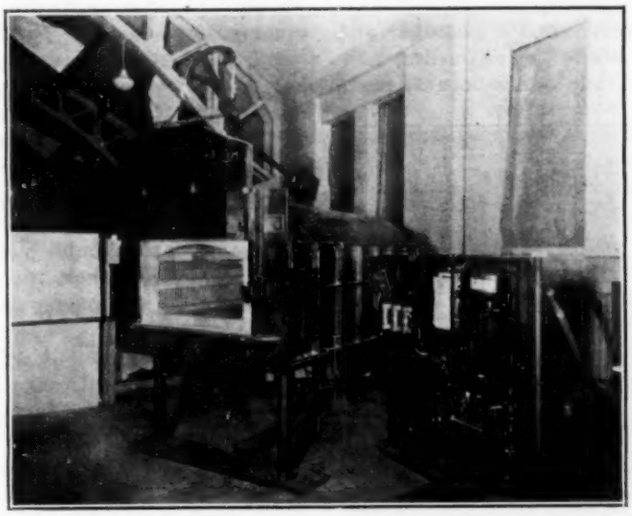


FIG. 1—ELECTRIC ENAMELING FURNACE WITH HEATING ELEMENTS IN SIDE WALLS AND ROOF

In general, vitreous enamels are prepared by fusing together various combinations of refractory materials, fluxes and opacifying agents to form glasslike frits. These are ground wet in ball mills (frequently with the addition of other raw materials such as clay) and applied to the ware either dry or wet. In the dry process, the fine powder is sifted upon the heated metallic surface, while with the wet process a water suspension of the enamel is made and the ware is dipped or sprayed. In all types of work, whether cast iron or sheet steel, it is customary to apply first a ground coat of such composition that it adheres perfectly to the metal and forms an adequate bond between metal and subsequent enamel coats. Cobalt oxide is quite generally employed in ground coats to impart the requisite properties, and as a result these are usually blue in color. Consequently in order to obtain white or light effects it is necessary to use at least two cover coats. Each coat is burned separately.

As a detailed consideration of raw materials and methods of preparing and applying enamels does not come within the scope of the present article, for a very thorough treatment of these points the reader is referred to Bureau of Standards Technologic Paper 142, "Materials and Methods Used in the Manufacture of Enameled Cast-Iron Wares," by Homer F. Staley, and Bureau of Standards Technologic Paper 165, "Enamels for Sheet Iron and Steel," by J. B. Shaw.

The enameling furnace has consisted of a relatively long, low, wide chamber to hold the work and a firebrick or clay muffle to separate it from the surrounding combustion products. The ware coated with enamel has been supported on racks or if very small has been laid upon flat pans. There are, in general, two methods of charging. According to one method the work is placed upon racks outside of the furnace and the racks plus the work are lifted by means of prongs and placed inside the furnace chamber. At the completion of the heat, the work and racks are again lifted out by the prongs. After cooling, the finished work is lifted from the racks and new work placed thereon. In this method of operation, racks are continually being brought up to furnace chamber temperature and then allowed to cool to room temperature. According to the second method, the work alone is lifted by means of prongs and placed upon racks permanently set upon the floor of the furnace chamber. In this method, as the racks are always at furnace chamber temperature and the fresh work only is brought up to furnace chamber temperature each cycle or each operation, much heat is conserved. In the case of the very smallest work, such as watch dials and jewelry, pans or trays are necessary and loss of heat on this account is unavoidable. In the case of large objects, such as bath tubs, it is a comparatively simple matter to carry the work by means of a two-pronged fork and set it down upon a pair of rails permanently set within the furnace. The second method of charging is, of course, the one to be employed wherever the character of ware will permit.

Within recent years a number of improvements upon the original clay muffle type enameling furnace have been proposed and employed. The most important of these are: 1. Carborundum or carbofrax brick muffle furnace. 2. Intermittent gas fire furnace. 3. Electric furnace.

The carborundum muffle furnace has been a development resulting from the improved bricks of this mate-

rial which have become available and the fact that this material has only about one-eighth the thermal resistance of fireclay. In this furnace, therefore, the old fireclay muffle has been replaced by carborundum; otherwise the furnace is practically the same. Owing to the high heat conductivity of the carborundum, a lower flame temperature suffices which is less severe upon the other refractory walls and a higher efficiency results. The carborundum muffles are expensive, however, and experience does not indicate definitely what length of life may regularly be expected under usual operating conditions.

The intermittent gas fire furnace is a development resulting from the desire to eliminate possibility of contamination from products of combustion. In this furnace the gas is burned directly in the chamber and the chamber walls are heated above the enameling temperature. The gas is shut off and enamel-coated ware

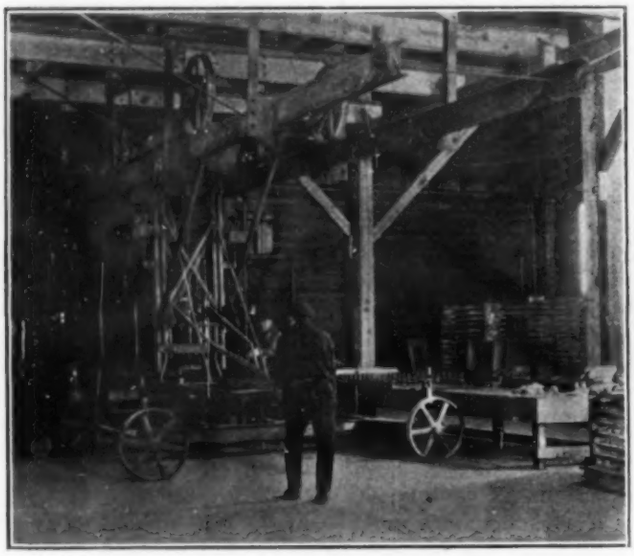


FIG. 2—FURNACE FOR ENAMELING SHEET IRON, SHOWING CHARGING MECHANISM

is inserted, and the enamel fused under falling temperature conditions, the work absorbing heat from the surrounding walls. Rather remarkable economy has been reported in the operation of one of these furnaces. Employing 500 B.t.u. gas at 50 cents per thousand cubic feet and enameling flat ware to a maturing temperature of 1,700 deg. F. at a rate of 240 pieces, of total weight of 690 lb. and surface 600 sq.ft. per hour, 1,260 cu.ft. of gas was consumed. The fuel cost was therefore only 63 cents per hour, or 9 cents per 100 lb., or 10 cents per 100 sq.ft.

The electric furnace for vitreous enameling has resulted from the desire to eliminate contamination and at the same time reduce the wear and tear upon furnace refractories, due to high flame temperatures. The idea has been to employ a heating source as uniformly distributed as possible at the walls of the furnace chamber, which would operate at a temperature above the necessary enameling temperature only sufficient to force the heat into the ware in the desired time. A number of advantages have been indicated, such as:

1. Smaller amount of burned and blistered ware.
2. Greater reliability—that is, less time lost due to furnace being too hot or too cold for proper enameling.
3. Saving in space by eliminating coal handling, oil or gas piping, storage or generation.
4. No possibility of contamination from fuel gases and owing to low temperature of furnace chamber refractories, no likelihood of contamination within the furnace chamber whatever.

Indications as to economy as a result of experience during the past year or so are that the cost of operating the electric furnace, when a moderate power rate is obtained, is closely comparable to the cost of operating the clay or the carborundum muffle furnace. With power at less than 1 cent per kw.-hr., a lower cost even may result. Clay and carborundum muffle furnaces produce 5-ft. enameled bath tubs at an overall fuel and maintenance cost of from approximately 30 to 90 cents per tub, or a total operating cost of from approximately 90 cents to $1.50 per tub. This is with an enameling labor cost of 60 cents per tub. With the same enameling labor cost of 60 cents per tub and power at 1 cent per kw.-hr., the comparative total operating cost in enameling with the electric furnace is $1.20 per tub. This closely coincides with the average fuel-fired furnace total operating cost. This is on the basis of 55 kw.-hr. power consumption per tub and 5 cents per tub maintenance. This is bearing in mind that a total operating cost should include all fuel and labor for firing, handling ashes, repairs on furnace, idle periods, rejections, lighting off periods, etc.

Typical Installations

A number of vitreous enameling electric furnaces have been installed which exhibit considerably different features of design and construction. A furnace designed to bake either of two classes of materials—cast-iron stove parts for 9 minutes at 1,250 deg. F. or sheet steel stove parts for 4 minutes at 1,400 deg. F.—has been described and illustrated in *Chemical & Metallurgical Engineering*, vol. 28, p. 364, Feb. 21, 1923, under the title "Electric Enamel Furnace Lowers Rejections on Stove Parts."

Watch Dial Furnace With Novel Conveyor

In electric furnaces especially designed for enameling and setting the letters of watch dials at 1,800 and 1,450 deg. F. respectively the problem of obtaining relatively high economy has been met in a most ingenious manner. The construction developed gives the following results: Amount of racks or conveying mechanism reduced to minimum; amount of heat lost by racks and conveyors in room very small; alternate heating and slight cooling of ware to produce better product accomplished by means of heating zones with cold zones between. This furnace is cylindrical in form, 6 ft. in diameter and 3 ft. high, with an annular heating chamber through which the ware passes on a ring conveyor built up of ¼-in. Nichrome plates, each 8 in. long by 2 in. wide. These are supported on ⅜-in. diameter Nichrome rods which extend down through a narrow slot in the insulating brickwork to a cast-iron channel ring, the whole conveyor ring (about 4 ft. in diameter) being driven by a ½-hp. motor through a gear train and a chain at speeds variable between ⅛ and ½ r.p.m. The bottom of the stationary part of the furnace has two rings projecting downward so that they form a sand seal with the channel at the bottom of the conveyor.

In front a section of the brickwork is cut away, thus exposing the conveyor, which is loaded and unloaded at this point by the operator. The roof of the heating chamber is formed of ⅜-in. crystalon plates to equalize the heat and prevent bits of

scale or firebrick from falling on the work. Directly above are the two layers of heating elements consisting of ¾x⅞-in. ribbon with the bends supported in niches cut in the brick work, and strands about ¾ in. apart. The elements are in three sections with spaces between so that there are really three heating zones with cooler zones between. Such alternate heating and slight cooling gives a better product in this case. In a later design of the same type furnace the two horizontal layers of heating elements are changed to a vertical position, one at each side of the heating chamber, for the purpose of reducing element temperature, securing greater mechanical strength and eliminating the need of the muffle plate. With about seventy dials on the conveyor at a time, a production of about 5,000 dials per day is obtained, these figures varying considerably depending upon the size of dial. The electrical capacity of the furnace is 30 kw., each heating zone taking approximately 10 kw. and being under separate automatic control.

This furnace is particularly interesting in comparison with parallel practice in enameling watch dials in the fuel-fired furnaces. Five or six dials coated with enamel are placed on a round refractory plate and set in the furnace, which is of oil-fired muffle type without a door and has a chamber, say 10 in. wide, 8 in. high and 18 in. deep. The plate is rotated from time to time so that all dials will be heated the same. At least once during the process the plate with the dials on it is withdrawn from the furnace and the dials are allowed to cool slightly before being placed again within the chamber. This practice for the improvement of product is responsible for the alternating heating and cooling zones provided in the electric furnace.

Obtaining Uniform Heat Distribution

Other electric enameling furnaces of chamber type have been in operation for a considerable number of months in which heating elements have been mounted in roof and floor as well as side walls for the purpose of causing the heat to strike the charge from all directions and distribute uniformly throughout the chamber. By this uniform distribution it has been sought to force the maximum amount of heat possible in a given time into the work without unduly raising the temperature of the heating elements themselves. Fig. 1 shows an 80-kw. furnace of this type. In the very latest furnaces of this type, while there are no door-heating coils, the wall coils are crowded somewhat toward the doors for the purpose of releasing a greater percentage of heat per unit wall area and compensating for the cooling effect of the door in the maintenance of uniform temperature. This concentration of heat supply is accompanied by spacing the grooves, and hence adjacent convolutions of conductor, a smaller distance, as, say, every ¾ in. as compared to, say, 1 in. in the remainder of the furnace heating surface, so that whereas the average maximum kilowatts released may be as low as 1.85 per sq.ft. of wall-heating surface, near the door it may be in the neighborhood of 2.5 kw. per sq.ft. or greater without increasing the watts released per unit of the heating element itself. The effect of the door upon furnace chamber temperature is still further minimized by means of an 18- or 20-in. vestibule. Long vestibules are, of course, undesirable owing to loss of time and convenience in loading and unloading operations.

A furnace of this general type has been in service for more than a year in the enameling of 5-ft. bath tubs. Approximately 340 tubs per week is the production of one enameler and one helper working piece rate operating such a furnace. This is an output of 60 tubs per 24-hour day of three shifts for 5 days, and 40 tubs for Saturday. In order to deliver this weekly output the men often, or usually, work at a rate of from 3 to 3½ tubs per hour and the furnace must be designed for such capacity and have the necessary electrical supply.

Operating Data and Costs on Sheet-Iron Enameling Furnace

Another furnace of this general type has been in operation for some months in the enameling of sheet-iron ware that is used about stoves and ovens. Fig. 2 is a front view of the furnace, showing the mechanism for charging the work and its supporting racks into the furnace. The furnace chamber is 4 ft. wide by 10 ft. long inside the vestibule. It is 13½ in. high at the sides and 17½ in. at the crown of the arch. A hearth area is then 40 sq.ft. The furnace floor area is 169 sq.ft.

The floor space taken by the charging device is 216 sq.ft., in addition to which the fork protrudes 11 ft. more beyond the carriage and is 26 in. wide. Two sets of racks only are employed—one within the furnace supporting the work being baked, the other on the carriage being unloaded and loaded. The weight of these racks, depending upon the type of ware being burned, is from 126½ to 159½ lb., and this weight must be raised about 500 deg. F. with each charge. Depending also upon the gage and type of ware, from eighteen to twenty-three loads of 35 to 40 lb. each, ware plus enamel, are burned per hour. A comparison of the weight of work and of racks charged indicates that improved economy would result could charging mechanism and practice be changed so as to leave one set of racks permanently in the chamber. Results of typical test runs made on this furnace are given in Table I.

Highest quality ware was obtained, due to absence of gases and to accurate temperature control. Unit cost of production is considered comparable to that obtained with oil-fired furnaces, oil at 6¼ cents per gal., due particularly to the high production per unit floor space.

The furnace operates on a sixty-cycle, three-phase, 220-v. circuit, regulation being obtained by the use of auto-transformers and a control panel automatically operated by indicating and recording controlling pyrometers from thermocouples located within the furnace chamber. Fig. 3 is part of a chart showing the furnace chamber temperature as recorded from a thermocouple projecting through the roof about 2 ft. from the furnace door. It shows the small amount of necessary temperature variation that occurs during the baking cycle. At the center of the furnace the variation is even less, averaging about 60 deg. F. Of course, the chamber temperature drops somewhat when the cold

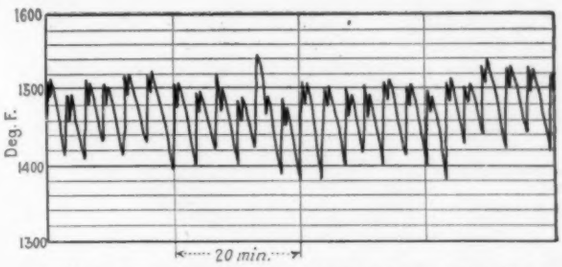


FIG. 3—PYROMETER RECORD FOR FURNACE IN FIG. 2

TABLE I—DATA ON SHEET STEEL ENAMELING FURNACE

Total weight of racks, lb.	126.5	126.5
Loads per hr.	22.6	19
Gage of metal	24	24
Weight of steel per sq.ft., lb.	1	1
Weight of enamel per sq.ft., lb.	0.17	0.17
Number of pieces per load	10	14
Sq.ft. per load	30	33.83
Sq.ft. per hr.	680	642.8
Total weight ware per hr., lb.	796	752
Power consumed, kw.-hr.	163.3	170.6
Cost per kw.-hr., dollars	0.0146	0.0146
Cost per hr., dollars	2.385	2.49
Cost per sq.ft., dollars	0.0035	0.00388
Weight of ware per kw.-hr., lb.	4.87	4.40
Sq.ft. work per sq.ft. hearth area	17	16
Labor cost per hr., dollars	1.70	1.70
Labor cost per sq.ft., dollars	0.0025	0.00264
Operating cost per sq.ft., dollars	0.006	0.00652

ware and racks are inserted and it rises to a maximum just before the new charge is inserted. This possible maximum is limited by the setting of the control pyrometer, which determines the temperature at which the contactor panel cuts power off the furnace.

The twenty-four heating coils in this furnace, each 5 ft. long, 8 in. wide, of No. 1 Chromel wire, ten coils in roof, ten in floor and two in each side wall, containing about 250 lb. total of metal, are distributed into two three-phase control groups. The group covering the front half of the furnace takes a maximum of 94 kw. and the group covering the rear half a maximum of 81 kw., making a total of 175 kw. maximum input to the furnace. The average consumption under regular operating conditions is 157 kw.-hr. per hour. As against a usual lighting off period of around 10 hours with fuel-fired furnaces, the lighting off period for this electric furnace after a 21-hour shut-down is only 3 hours and the consumption during this period is only 210 kw.-hr. The closed furnace actually drops only 350 deg. F. in 24 hours. Application of power for 30 or 45 minutes will raise the temperature again 500 deg. F. After this is done the furnace is allowed to saturate at 1,700 deg. F. for the remainder of the 3-hour lighting-off period. After saturation, only 18.3 kw.-hr. is required to maintain the temperature of the closed furnace at 1,700 deg. F.

Endurance of Duralumin, Electron Metal and Manganese Bronze*

By R. R. Moore
Engineering Division, U. S. Air Service, Dayton, Ohio

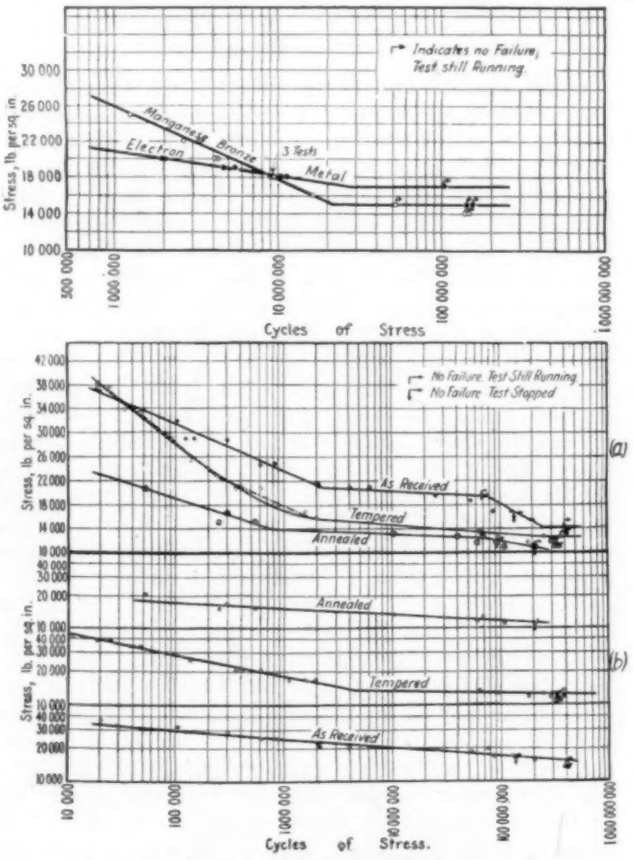
ENDURANCE TESTS and further investigation of the general physical properties for three of the most important of the light alloys have been carried out by the Engineering Division of the U. S. Air Service at McCook Field, Dayton, Ohio. For the former a rotating beam machine was used, which subjected the test bar to alternating stress. The general character of the results is shown by the curves reproduced herewith. In contradistinction to the results found for steel and other ferrous materials by H. F. Moore at the University of Illinois, in whose tests a definite endurance limit was found—that is, a stress below which the material would stand an indefinitely large number of stress reversals—the McCook Field tests indicated that beyond an early endurance limit there is a further dropping off of the curve, at least for Duralumin tested "as received."

TABLE I—GENERAL PHYSICAL PROPERTIES AND ENDURANCE LIMITS

Each value given is the average of two tests except as specified.

	Duralumin				
	As Received	Tempered At 920 Deg. F.	Annealed At 700 Deg. F.	Electron Metal	Manganese Bronze
Tension					
Elastic limit, lb. per sq.in.	22,500	16,880	6,230	5,150	10,240
Proportional limit, lb. per sq.in.	25,030	18,550	6,880	6,260	13,000
Tensile strength, lb. per sq.in.	50,960	51,170	25,250	36,500	70,000
Elongation in 2 in., per cent	16.0	29.3	25.0	17.5	32.8
Reduction of area, per cent	50.4	47.5	60.8	20.5	40.8
Modulus of elasticity, lb. per sq.in.	10,134,000	10,950,000	10,737,000	6,135,000	14,235,000
Compression					
Proportional limit, lb. per sq.in.	20,860	17,270	6,860	8,150	a15,500
Compressive strength, lb. per sq.in.	50,060	50,090	26,620	47,780	a4,390
Shear					
Ultimate strength, lb. per sq.in.	29,120	16,240	26,580	16,970	43,190
Torsion					
Proportional limit, lb. per sq.in.	18,970	14,090	7,820	3,930	11,140
Modulus of rupture, lb. per sq.in.	43,260	47,200	27,080	24,630	61,890
Modulus of rigidity, lb. per sq.in.	3,838,000	3,838,000	3,838,000	2,161,600	4,619,000
Hardness					
Scleroscope, magnifying hammer	19	22	12	19	17
Brinell, 500 kg.	100	100	50	64	93
Rockwell, ⅛-in. ball	53	63	..	33	65
Notched Bar Impactb					
Charpy round notch, ft.-lb.	13.9	19.4	17.3	2.9	21.0
Charpy "V" notch, ft.-lb.	.....	.....	.....	5.5	34.4
Izod round notch, ft.-lb.	.....	.....	.....	3.0	18.4
Izod "V" notch, ft.-lb.	.....	.....	.....	5.0	29.4
Specific Gravity	2.80	2.80	2.80	1.78	8.26
Endurance limit, lb. per sq.in.	14,000	12,000	10,860	17,000	15,000

a Average of six tests.
b Each value is the average of four tests.



ALTERNATING-STRESS TEST RESULTS

Upper diagram, manganese bronze and electron, plotted on semi-logarithmic paper; middle diagram, Duralumin plotted on semi-logarithmic paper; lower diagram, Duralumin on logarithmic paper.

*Abstracted from a paper read before the Atlantic City convention of the American Society for Testing Materials, June 26, 1923.

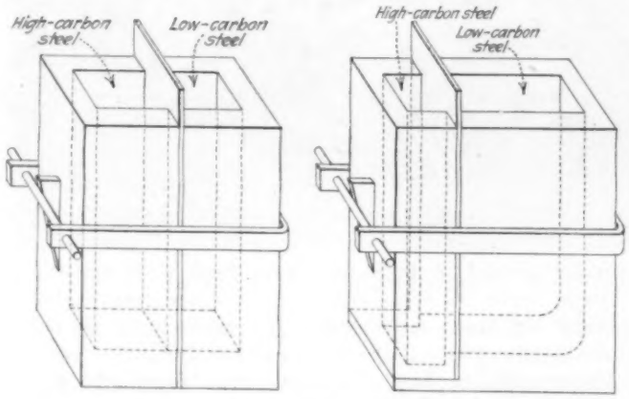
Manufacture of Crucible Composite Steel

It Is Possible to Cast Crucible Steel of Different Compositions Into the Same Mold, Thus Producing a Variety of Composite Steels of Unique Properties, and Which Can Be Made in No Other Way

BY ARTHUR W. F. GREEN
Metallurgist, The John Illingworth Steel Co., Frankford, Philadelphia, Pa.

COMPOSITE steel as made by the crucible process is a combination of low-carbon and high-carbon steel cast in an integral form. The process was developed to secure a material which would be best for various tools requiring a very hard working surface and a softer back or shank which could be easily machined. Composite steel is a combination that is more durable than welded steels of like analysis. Difficulties that arise in welding a high-carbon to a low-carbon steel, especially before the advent of the modern electric welding machines, are generally known by steel workers.

Dr. Percy Longmuir in a paper read before the Birmingham (England) Metallurgical Society and reported in the *Iron and Coal Trades Review*, Oct. 28, 1921, calls this product combined iron and steel. This



FIGS. 1 AND 2—MOLDS FOR POURING CRUCIBLE COMPOSITE STEEL

name is incorrect for the product that I am discussing, since the low-carbon portion of the material is steel by virtue of the process of manufacture and contains from 0.1 to 0.4 per cent carbon. The high-carbon steel may contain from 0.8 to 1.30 per cent carbon depending upon the use to which it is to be put.

The following is a typical chemical analysis:

	C	Mn	P	S	Si
Low-carbon portion	0.30	0.25	0.02	0.02	0.10
High-carbon portion	1.20	0.25	0.02	0.02	0.20

Crucible composite steel has been made in this country for 40 years, and while it is still manufactured, the quantity is not very great. This is believed to be due wholly to the fact that little is generally known about its remarkable adaptability to a great many uses where straight carbon and even alloy steels are now specified.

Crucible composite steel is made in split molds having a vertical partition, which is removable. Some of the molds are equally divided, as shown in Fig. 1, so that the ingots made in them are of equal portions of low and high carbon. This type of mold is made in two sizes for the production of ingots weighing 200 lb. and

Fig. 3—Rolled Section for Skate Runner

400 lb. respectively. Other molds have been developed along the same general lines except that varying portions of low- and high-carbon steel are combined in them. One of the latter type that has been used successfully is for making steel used for ice skate runners. This type of mold is illustrated in Fig. 2. Skate steel made in these molds after proper fabrication has a thin edge of high-carbon steels which forms the runner of the skate, while the remaining portion is low-carbon steel containing 0.2 to 0.3 per cent carbon. Fig. 3 represents a section of rolled skate steel much enlarged to accentuate the different portions of the high and low carbon, as well as to show the extent of the fusion or welding between the materials. The high-carbon portion is seen to assume a crescent shape overlapping the low-carbon area. The small numbers used in the drawing are to indicate several distinct zones of varying carbon content in the composite material, as well as to show graphically a gradual tapering of the carbon content in the material from the low- to the high-carbon areas. Zone No. 1 represents the low-carbon steel of 0.3 per cent carbon; No. 2 the graduation from 0.3 to 0.5 per cent carbon; No. 3, from 0.5 to 0.8; No. 4 from 0.8 to 0.9 carbon; and No. 5 from 0.9 to 1.20 per cent carbon.

The molds used for making composite steel are of cast iron, and are usually in two sections, although special molds are sometimes made of more than two

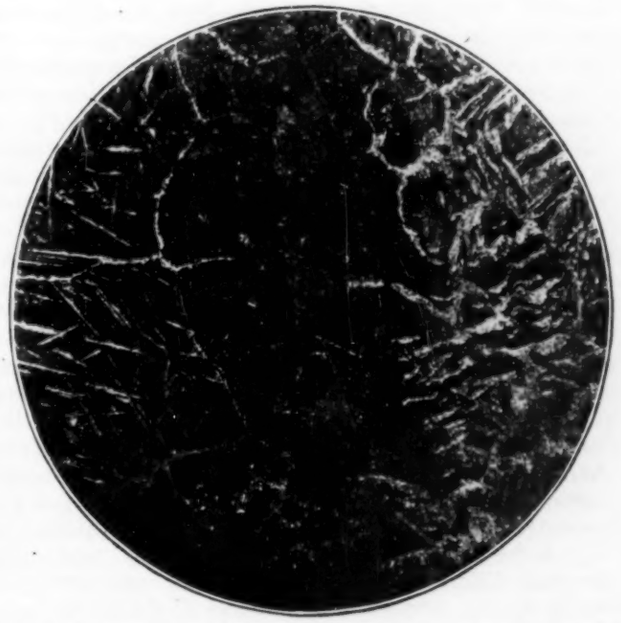


FIG. 4—MICROSTRUCTURE OF ZONE OF FUSION, 10 PER CENT HNO_3 ETCHING. × 40

sections. After preparing the inside of the sections of the mold by smoking with burning rosin or otherwise coating them with some suitable carbonaceous material to insure clean surface on the ingots, they are set up with the partition inserted between the sections. A stout U-shaped clamp such as shown in Figs. 1 and 2 is placed around the mold, and a wedge is driven tightly into place to insure close fitting and prevent leakage during the pour. As soon as one portion or section is filled with metal and the metal has solidified on the outside, the wedge is loosened sufficiently to allow the partition to be withdrawn, after which the joint is again driven tightly shut and the remaining portion filled with steel of another composition.

The hot metal coming into contact with the sides of the mold and the partition starts to freeze at those points of contact almost immediately. It is because of this that it is possible to withdraw the partition as soon as the one side of the mold is filled, if the mold is not too high and the hydrostatic head of the liquid interior is not sufficient to break through the thin chill. Naturally, great care must be exercised in this procedure not to break through the thin wall of crystallized steel which had formed. It has been found to be good practice to pour the low-carbon steel into the mold first, especially in those cases where the quantity of high-carbon steel is small as compared to the amount of low-carbon steel.

When proper care has been exercised throughout the operation of melting the steel and casting the ingots, it will be found that the two steels have fused together (welded) along the line at which the partition stood. The nature of this joint may be seen by referring to the photomicrographic study of the steel as cast, shown in Figs. 4 and 5.

It is believed that this fusing or welding takes place as a result of the diffusion of carbon from the high-carbon steel into the low-carbon steel, which migration continues until the temperature of the ingot has fallen below that temperature at which carburization of the low-carbon steel can take place (Ar_3). If the low-carbon steel is allowed for any reason to become too cold before the high-carbon steel is poured into place, no welding occurs. Instead, the high-carbon steel crystallizes as soon as it touches the low-carbon material. It is good practice to have the high-carbon steel drawn from the furnace just as the partition is being removed from the mold, so that it will be as hot as possible before teeming and thus aid in raising the temperature of the low-carbon steel with which it comes into contact.

It is because of the splendid fusing or welding of the two different steels that crucible composite steel can be readily worked into a number of useful sizes and shapes, such as, for instance, the skate steel shape illustrated in Fig. 3.

One of the difficulties encountered in its manufacture is that of making the steel sound. Because of the various kinds of molds that may be used and the varying portions of low- and high-carbon steel that the ingots may contain, it is impossible to use hot tops on the ingot molds to limit piping. It is therefore essential that only the best and cleanest of materials be used to charge the crucible before melting. The low-carbon steel may be made by melting down a charge of good grade acid open-hearth steel low in carbon, phosphorus and sulphur, but the best results have been obtained by using a charge of good grade "melting bar" (a good grade of low phosphorus puddled iron) cut into suitable size for quick melting and easy packing in the crucible. (A charge of melting bar doubtless accounts for the naming of the resultant material "iron.") To the charge of melting bar is added small amounts of ferromanganese and a small amount of broken crucible-steel slag, which aid in fluxing the charge. If clay crucibles are used, it is necessary to add a few ounces of charcoal to the charge. With the use of graphite crucibles this is not done, as the necessary carbon is taken from the crucible. Charcoal may be added in graphite pots if it is desired to have higher carbon than usual in the resultant steel. Low-carbon steel is generally melted in pots that have been used for two or three heats of some other steel, since less carbon is taken up from crucibles which have been previously used than when they are used for the first time. It is desirable to have the low carbon from 0.25 to 0.35 per cent, and if first-heat crucibles are used the carbon is very likely to be higher than that.

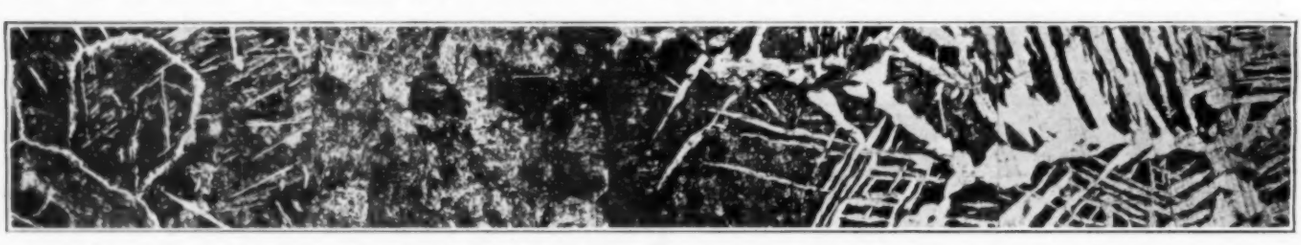


FIG. 5—ASSEMBLY OF A SERIES OF EXPOSURES ACROSS TRANSITION ZONE IN COMPOSITE STEEL CASTING. × 100

High-carbon steel is made by using a base charge of melting bar together with small amounts of selected crucible tool-steel scrap. Ferromanganese and oxide of manganese are used for oxidizing the charge, and charcoal and wash metal for carburizing. Small amounts of ferrosilicon are added depending upon the amount of silicon desired in the metal. Care must be taken in melting the high-carbon steel, especially when it is in the same furnace in which the low-carbon steel is being melted, since a higher temperature is required for the latter.

Consequently it is advisable to place the pots containing the high-carbon charge in the coldest portions of the furnace. Even when these precautions are taken the high-carbon steel will be melted sooner than the low-carbon charge. Because of this it sometimes happens that the melter orders the heat from the furnace before the low-carbon steel is entirely melted. When this is done, lumps of melting bar will be seen to fall into the molds when the steel is poured. Ingots made this way are naturally unsound; the low-carbon steel has a tendency to crumble during hammering and rolling.

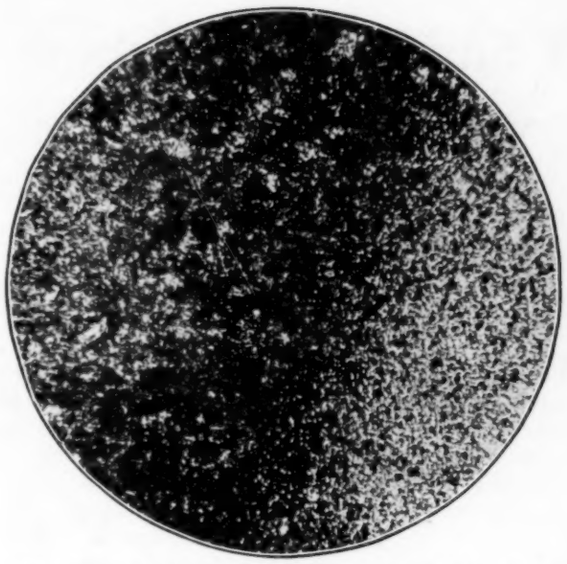


FIG. 6—WELDED REGION AFTER ROLLING. × 50

To work the ingots into usable sizes and shapes, they are cogged and finished to required size and shape under the hammer, or cogged only into such size and shape as may readily be used in the rolling mill. For making certain sizes of die blocks, for instance, the material is worked entirely under the hammer. For such material as skate steel it is necessary to hammer the ingots from a shape 8½x3x20 in. into a small billet about 3 in. square by 4 ft. in length, so that it may be rolled into the finished shape illustrated in Fig. 3.

The temperature at which crucible composite steel is worked either in the hammer shop or rolling mill depends entirely upon the carbon content of the high-carbon portion. The need of uniformity and soundness in the low-carbon steel portion of the bar is readily understood, since in composite steel it is worked at a lower temperature than steel of that analysis should be worked. However, no difficulties arise in rolling this steel if ordinary care is exercised.

Figs. 6 and 7 are selected from a photomicrographic study of the material after rolling. Grain-refinement due to working is quite evident. The fusion or welding zone is also quite homogeneous. No difficulties arise in heat treating this steel.

Hardening Practice

Hardening rationale for this material may best be understood by keeping in mind the relation of the high-carbon and low-carbon portions as shown in Fig. 3. Assuming that it is hardened by quenching in water from a correct temperature, the outside edge of zone 5 will be martensitic. Small portions of zones 3 and 4 which are close to the outer edge will also be martensitic. Back of the martensitic edge will be found a martensitic-troostitic zone making up the remaining portions of zones 5 and 4. This gradually tapers to troostite and then into sorbite as the effects of the hardening extend into the lower carbon zones 3 and 2. Back of the hardened areas gradually appears the low-carbon material of free ferrite and pearlite. The tapering is quite gradual because of the different carbon contents of the various zones, as previously explained, and because of diffusion of carbon during the various heatings while working and heat-treating. It will be readily appreciated that crucible composite steel with the hardening properties described will resist shock to a much greater extent than a straight carbon steel either completely or only partly hardened.

Utility of the Product

The ductile back and a hard face make this material ideal for many uses. Dies made from it have for some purposes given superior service to those made of straight carbon steel. Knives, such as those used in wood-working machinery and subjected to repeated shock, have given excellent results when made from crucible composite steel. Breaks along the welded surface have never been encountered in regrinding or re-treating this steel.

Crucible composite steel as described in this paper, when made in ingots yielding equal portions of high- and low-carbon steel, has been used chiefly for file making dies or coining dies. It is particularly adaptable to dies requiring long shanks which have to be fashioned more or less after the face has been hardened.

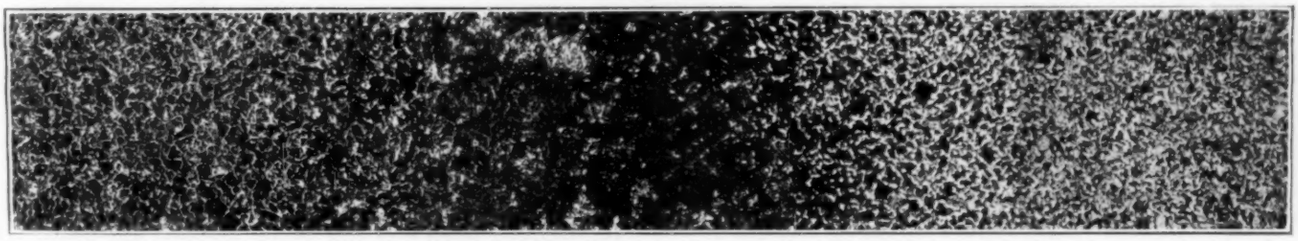


FIG. 7—SERIES OF EXPOSURES ACROSS TRANSITION ZONE IN COMPOSITE STEEL FORGING. × 100

Various articles have been made from steel in which small portions of high-carbon steel are combined with low. Among these are skates, as described previously, knives for wood-working tools, and special knives (such as for lawn mowers) in which it has been advantageous to have a soft or easily machined back.

Axes and kindred tools offer a wide field of application for this material especially because of the resistance to shock. Since it is possible to cast this steel in sandwich fashion—that is, to have the low-carbon steel cast between two smaller portions of high-carbon steel (or *vice versa*)—it is adaptable for various kinds of hammers as well as other tools requiring two hard working edges, with a soft center.

Manufacturing is by no means in the experimental stage, but has been carried on for a number of years both here and in England. Because of the high quality of the product present by virtue of the high-grade material needed for its production and the general care used in its manufacture, it should be applicable to many special dies and tools where resistance to shock is especially desirable and which requires for various reasons a soft back with a hard face, two hard faces with a soft center, or a hard center and two soft edges.

A Short Cut Interpretation of Drying Data

A Method of Plotting Data Which Is of Advantage in Solving a Somewhat Complicated Relationship

By Alan F. Randolph
Chemical Engineer, E. I. du Pont de Nemours & Co.

In certain studies of drying it was observed that the data confirmed a hypothesis that the rate of loss of solvent was proportional to the amount of solvent present over and above a final residue not removable by the method of drying—i.e., that, if

s = amount of solvent present
t = time
and a = the amount of the residue,

$$\frac{ds}{dt} = - \text{ (constant) } (s - a).$$

From this

$$s = be^{-kt} + a,$$

in which

b is a constant the value of which depends upon the original solvent content
and k is a constant the value of which depends upon the thickness of the material.

With the value of b the same for all thicknesses, and values of k for various thicknesses available by calculation from the data, it was desired to construct a chart from which could be read off the normal solvent content of material of any thickness at any point in the drying process. On squared paper or semi-logarithmic paper, used in the ordinary way, the equation gives a curved line and the construction of the chart would have involved the tedious work of calculating a number of points for each of the values of k, and laying out the curved lines thus located.

It is the added constant a which causes curvature on semi-logarithmic paper; without it the equation would give a straight line. Consideration of this fact suggested a scheme for avoiding the use of curves—namely, (1) cut off the constant, (2) plot the equation without it, on semi-logarithmic paper—i.e., locate two points and draw a straight line, (3) then, in order to restore the constant, relabel the ordinates, increasing each by the amount a.

To illustrate, let us assign convenient values to the constants,

$$b = 9 \quad k = 1 \quad a = 1,$$

giving the equation

$$s = 9e^{-t} + 1$$

from which corresponding values of the variables can be calculated—e.g.

t	s	t	s
0	10	3	1.45
1	4.31	4	1.16
2	2.22		

Plotting these on semi-logarithmic paper we get the curve shown in Fig. 1.

If instead we omit the constant a (= 1), we have

t	s	t	s
0	9	3	0.45
1	3.31	4	0.16
2	1.22		

which points, plotted on the same paper, give a straight line representing the equation

$$s = 9e^{-t}.$$

This straight line in Fig. 1 is at all points one unit

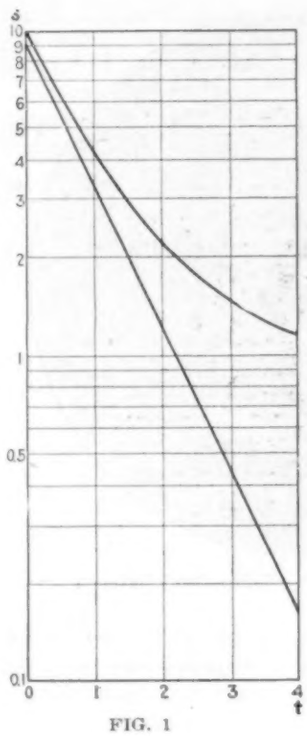


FIG. 1

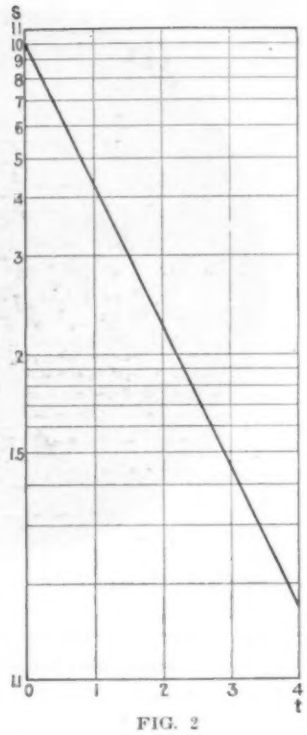


FIG. 2

below the curve. If now we increase the designation of each ordinate by this amount—i.e., by the amount a, changing 10 to 11, 9 to 10, 0.1 to 1.1, etc., as in Fig. 2, this same straight line now represents the original equation

$$s = 9e^{-t} + 1$$

It will be noted that the substitution of the straight line of Fig. 2 for the curve of Fig. 1, with the corresponding change in the labeling of ordinates, increases the vertical height of the chart, making possible more accurate reading of s as it approaches its limiting value a, the ordinate of which can, however, no longer be shown.

Wilhelmy's Equation Also Simplified

A similar method can be used to replace with a straight line the curve representing Wilhelmy's equation

$$\frac{dy}{dt} = k(c - x)$$

or

$$y = c - ce^{-kt}.$$

On semi-logarithmic paper the values of ce^{-kt} lie in a straight line. The procedure is as follows:

(1) Calculate two values of ce^{-kt}, plot them on semi-logarithmic paper and draw through them a straight line. It is convenient to choose as one of the points that representing

$$t = 0 \quad ce^{-kt} = c.$$

The straight line evidently intersects the axis $t = 0$ at ordinate c.

(2) Relabel this ordinate zero and, numbering downward 1, 2, etc., relabel each ordinate in such a way that the sum of the original and new designations equals c. For example, if $c = 10$, 10 is changed to 0, 6 to 4, 1 to 9, 0.5 to 9.5, etc.

The straight line, referred to the ordinates as relabeled, now represents the equation given, for the distance downward from the new t axis to any point on the line is c minus ce^{-kt}.

Study Behavior and Fundamental Properties of Engineering Materials

Twenty-sixth Annual Meeting of American Society for Testing Materials at Atlantic City, June 25 to 29, 1923, Stresses Utility of Metals, Fuels, Paint, Concrete, Rubber and Structural Materials

EDITORIAL STAFF REPORT

STANDARD specifications and methods of testing were forced to give way to fundamental properties and behavior of materials as the keynote of the important meeting of the American Society for Testing Materials held at Atlantic City, June 25-29, 1923. To be sure, the society's specification work on standard materials—iron and steel, coal and coke, concrete, wood—has continued to progress and the effort has been pushed far into fields of miscellaneous materials, such as petroleum, paint, rubber, textiles, etc. Nevertheless the outstanding feature was the unusual number of important technical papers and the topical discussions often involving such lively discussion as to be carried beyond the stated time allotments. The behavior of concrete, for example, was not concluded until far after midnight, and there were several other sessions that should have entitled the reporter to "overtime" compensation.

A significant milestone in engineering progress was marked by this society's enthusiastic approval of a program for systematic and organized research in materials. The surprising thing is that this recognition has not come sooner. Specification-making is not a cut-and-dried hacking away at the inanimate. It is the molding of live, changing knowledge so that materials can be made and sold in a form that will give them the maximum of utility and service. In this process there is no more effective agency than fundamental scientific research.

From the viewpoint of society policy, there was much of good advice in the address of the retiring president, George K. Burgess, director of the United States Bureau of Standards. With particular emphasis he pointed out the important relation of research to standardization. In this connection he said:

> No demonstration is needed before this audience of the intimate and fundamental nature of this relation. We all recognize that material standards are based on the findings of experiment, practice and service, and the numerical values and tolerances—both chemical and physical—inherent in all quantitative specifications cannot, in general, be fairly stated without research. It is also evident that as the state of the art of production improves, as the quality of raw material available for a given product changes, as new limitations are imposed on the use of a product, for these and many other reasons it follows that our specifications will necessarily always be in a state of revision. The balancing of all these complex, constantly changing factors entails oftentimes a heavy burden of experimental research. Again, there is that intangible but very real factor, a psychological one, of mutual confidence, which must be established between consumer and producer; otherwise penalties will be exacted by one party or the other, resulting inevitably in waste. For uncertain knowledge is always certain ignorance and the ignorant buyer is at the mercy of the seller.

To stimulate the research work of this society, Dr. Burgess proposed the appointment of a committee to survey the situation and report a plan of procedure.

The report of the executive committee, read by Secretary-Treasurer Warwick, showed important gain in membership, a comfortable financial condition and a successful publication policy. An important announcement was the decision to hold an international meeting on engineering materials in connection with the engineering congress planned for the sesquicentennial exhibition in Philadelphia in 1926. At the close of Monday's session the following officers for the ensuing year were announced: President, Guilliaem Aertsen, Bethlehem Steel Co., Chicago, Ill.; vice-president, W. H. Fulweiler, United Gas Improvement Co., Philadelphia; secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa. Members of the executive committee: J. H. Chubb, Universal Portland Cement Co., Chicago; T. G. Delbridge, Atlantic Refining Co., Philadelphia; P. H. Walker, Bureau of Standards, Washington, D. C.; H. L. Scott, H. L. Scott & Co., Providence, R. I.

Four sessions of the convention were concerned with non-ferrous and ferrous metallurgy, particularly with the important reports of a number of standing committees. The group on corrosion of iron and steel made further report of the atmospheric exposure tests at Pittsburgh, at Fort Sheridan, Ill., and at Annapolis. The results of these tests confirm the previously indicated conclusion that steel containing copper is much more resistant to corrosion than steel free from copper. Three other series of tests, as yet uncompleted, indicated that the addition of copper to steel did not increase its resistance to corrosion in water immersion.

The committee on corrosion of non-ferrous metals and alloys, organized in 1922, decided to do no work of research into the mechanism of corrosion, but for the present at least will limit its activities to developing standard corrosion tests.

Dr. Burgess gave a preliminary report for the joint committee on investigation of phosphorus and sulphur in steel. It was stated that preliminary investigations using plate steel with suphur ranging up to 0.15 per cent yielded results substantially the same as previously reported for rivet steel, showing no influence of sulphur variation upon strength properties.

Two important papers at the second session included a discussion of the resistance of manganese bronze.

Duralumin and electron metal to alternating stresses by R. R. Moore (abstracted on p. 58 of this issue) and a paper on the endurance properties of steel by D. J. McAdam, Jr. The latter was a continuation of a previously described investigation (see *Chem. & Met.*, Dec. 14, 1921) to determine the endurance limit of various carbon and alloy steels at 10,000,000 repetitions of alternating tension-compression and alternating torsion stresses.

Chemical Limits for Cast Iron.—A topical discussion: Is it desirable to include chemical requirements in specifications for cast iron? brought out the need for fixing chemical limits in certain cases, a particular example being that of car wheels and locomotive cylinders. Robert Job, who upheld the affirmative side of the discussion, was well supported by H. J. Force. Richard Moldenke urged that the foundryman be allowed to meet the required physical properties with whatever chemical composition he finds suitable. In his presidential address Dr. Burgess also questioned the efficacy of simultaneous chemical and physical requirements in many metal specifications.

How Define "Consistency"?

The more or less conflicting usage of the term "consistency" prompted the society to hold a symposium in order to discuss the principles underlying the measurement of consistency, plasticity and related properties. The discussion was introduced by F. G. Breyer and Henry Green of the New Jersey Zinc Co., who were followed by representatives of the various committees interested in these properties. Breyer and Green favored the following definition: "Consistency is that property of a plastic material which it possesses by virtue of its yield value and mobility and manifests itself as resistance to flow." W. E. Emley of the lime committee said that in the lime industry there is difficulty in distinguishing between consistency and "viscosity" and "plasticity." Personally, he held, however, that plasticity is an inherent quality of lime and has nothing to do with its consistency. Prof. D. A. Abrams of the concrete committee submitted the definition that consistency is the relative plasticity or workability of freshly mixed material. R. E. Wilson, reporting for the sub-committee on petroleum greases, insisted that consistency should be defined in terms of known factors —yield point, mobility, elasticity and texture—which must be measured individually and studied together if a consideration of consistency is required. Prof. E. C. Bingham declared that unless it is possible to make consistency a definite property, capable of quantitative measurement, we should not attempt its definition. After stating the quantitative expressions for the various terms—viscosity, plasticity, and mobility—Professor Bingham suggested that the present looseness in the definition of consistency might be avoided if the term were used to refer to the reciprocal of mobility, for which no expression now exists. Dr. Herschel of the Bureau of Standards and Dean Johnson of the University of Maryland disagreed with the attempt to make consistency a limited physical term. Custom and usage have already given it a meaning to which the scientist should not do violence.

The symposium was followed by a topical discussion of glue testing, introduced in a brief statement by Jerome Alexander. He was followed by F. S. Williams, who reviewed the work of the National Association of Glue Manufacturers during the past 2 years on classifying and evaluating glues. Dr. J. R. Powell of the Armour Glue Works and Dr. A. D. Richardson, chief chemist for Swift & Co., described the viscosity pipette and the Bloom gelometer (see *Chem. & Met.*, p. 551, March 21, 1923), which have been developed by the association. The discussion of the need of standardization was carried further by representatives of the consuming industries, by Dr. Robert H. Bogue of Lafayette College and by Wilbur L. Jones of the Forest Products Laboratory, Madison, Wis.

Active Sessions on Paints and Oil

In the session on preservative coatings a paper was read by H. A. Nelson and G. W. Rundle of the New Jersey Zinc Co. describing elongation measurements of paint films and supporting the value of this method of attack on paint and varnish problems. This was followed by two papers on white pigments and ultra-violet light. There was an agreement in experimental results, both papers showing that lead pigments reflect and the zinc pigments absorb ultra-violet light. Prof. A. H. Pfund, who gave the first paper, however, held that it was the "function of the pigment to absorb harmful radiations before they have penetrated to any appreciable extent." R. H. Hallet, on the other hand, held that "only that portion of the ultra-violet light which is absorbed can have any influence, as the ultra-violet light which is reflected or transmitted passes out and away from the film and can have no further effect on it." Considerable discussion followed, but in the main only intensified the long-standing zinc oxide-white lead controversy.

The petroleum industry was well represented by its committee on petroleum products and lubricants and the advisory committee of the American Petroleum Institute. Both groups held active and enthusiastic meetings. The report of the former committee was presented by K. G. Mackenzie at the session held under the chairmanship of T. G. Delbridge. Five new tentative standards were proposed, three existing tentative methods were revised and one was withdrawn. R. E. Wilson's report of the sub-committee on greases, already referred to in the symposium on consistency, brought forth considerable discussion, particularly in connection with a new apparatus for testing hardness.

Behavior of Concrete

Perhaps the most important single session of the meeting was the symposium on the behavior of concrete. The discussion was introduced by Frank C. Wight, managing editor of *Engineering News-Record*. P. H. Bates of the Bureau of Standards, after considering cement requirements for various conditions of exposure, concluded that while improvements in cement were needed, still our slogan should be "Concrete for Study." D. A. Abrams emphasized the need for studying aggregates. R. B. Young, in considering methods of proportioning and mixing, emphasized the necessity for more careful measuring and more intimate study of the mechanism of mixing and the influence of plant design. Papers by Arthur P. Davis, P. J. Freeman, A. T. Goldbeck, S. C. Hollister and G. M. Williams cited numerous examples of the behavior of concrete under service conditions. W. C. Hart of the Portland Cement Association in a written discussion showed some very favorable examples of the weathering of concrete structures. This was followed by informal discussion involving more than a score of those present.

New Jersey Ceramists Discuss Tunnel Kilns and Feldspar

Record Attendance at Summer Meeting of New Jersey Clay Workers' Association and Eastern Section, American Ceramic Society

THE SUMMER MEETING of the New Jersey Clay Workers' Association and Eastern Section of the American Ceramic Society was held on June 29 at the Trenton Country Club, with about 120 members and guests present. During the luncheon which opened the meeting, brief addresses were made by Charles Howell Cook, president of the Cook Pottery Co., Trenton; Theodore A. Randall, secretary, National Brick Manufacturers' Association; Will P. Blair, president, National Paving Brick Manufacturers' Association; Charles W. Crane, president, the Crossman Co., South Amboy, N. J.; and LeRoy H. Minton, general superintendent, the General Ceramics Co., Metuchen, N. J., chairman of the executive committee of the association and former president.

With Andrew Foltz, head of the Lambertville Pottery Co., Lambertville, N. J., president of the association, presiding, a brief business session followed. A deficit of about $1,000 due to work in connection with the new Ceramics Building at Rutgers College was wiped out by subscriptions from members present.

Committees were appointed to handle all details in connection with the meeting of the American Ceramic Society to be held at Atlantic City next February.

An important committee was appointed from the membership of the association to work and co-operate with the Board of Trustees, Rutgers College and State University of New Jersey, with regard to the conduct of the new Ceramics Building at the institution and the courses of study to be prescribed and followed. This committee will be composed of Abel Hansen, head of the Fords Porcelain Works, Perth Amboy, chairman; Charles A. Bloomfield, Bloomfield Clay Co., Metuchen; Charles Howell Cook; H. A. Brown, head of Lenox, Inc., Trenton; and F. W. Dinsmore, Imperial Porcelain Works, Trenton.

NEW JERSEY CERAMISTS IN SUMMER SESSION AT TRENTON

Increasing Use of Tunnel Kilns

The principal address of the technical session was made by Prof. Carl B. Harrop, department of ceramic engineering, Ohio State University, Columbus, on the subject of "The Application of Tunnel Kilns in the Firing of Ceramic Wares." In opening, Professor Harrop said that his talk would deal with tunnel kilns in general and not with any particular type of such character of kiln. In the use of the tunnel kiln as compared with periodic operation, there is a fuel saving of 50 to 85 per cent. For successful operation a higher type of kiln-burner than usual is necessary and failures of such kilns often are due to a combination of circumstances in which the kiln-burner is no mean factor. Perhaps the best evidence of the practicability of these kilns is the marked growth in the number of installations, a point which Professor Harrop emphasized by means of the data given in the accompanying table. This classifies by character of ware all tunnel kilns of various types which have been constructed and operated more or less successfully during the past 13 years, to the best of the speaker's knowledge and records. It was mentioned as being at least 95 per cent correct.

CLASSIFICATION OF TUNNEL KILN INSTALLATIONS

Character of Ware	No. of Kilns
Vitreous china	3
Semi-porcelain	9
Sanitary ware	14
Cooking and art ware	1
Stoneware	2
Refractories	6
Floor and wall tile	12
Terra cotta	1
Brick and hollow tile	15
Drain tile	1
Roofing tile	2
Electrical porcelain	8
Carbon electrodes	3
Abrasives	1
Specialties	2
Total	80

Feldspar Classifications and Specifications

The second and concluding paper of the technical session was by Chester G. Treischel, General Electric Co., Pittsfield, Mass., on the topic, "Feldspar Classifications and Specifications."

This dealt largely with the work of the American Ceramic Society along these lines. It was the speaker's opinion that the society should not draft a set of specifications for feldspar, as this is rather a matter for the individual purchaser. On the other hand, it was set forth that the society should, properly, publish a classification of feldspar. A committee composed of six consumers and four producers is now working on the proposition, and will make a report at the annual meeting of the society next February.

An Extension of the Theory of Gas Absorption Towers

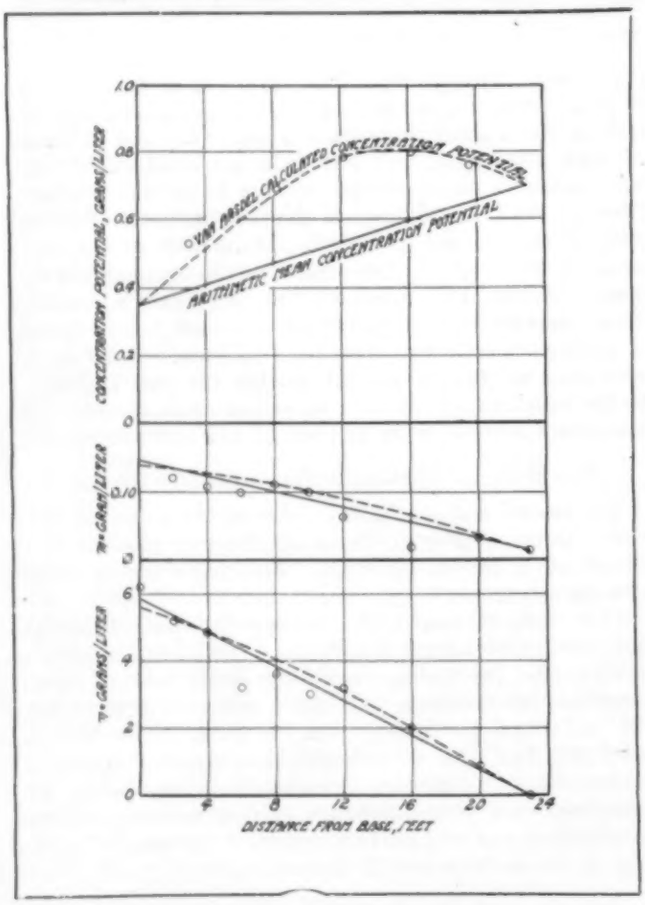
Criticism of W. B. Van Arsdel's Discussion of the Above Subject and a Comparison of Data Calculated by Two Methods

By R. T. Haslam
Director of the School of Chemical Engineering Practice, Massachusetts Institute of Technology

In THE May 21, 1923, number of *Chem. & Met.* W. B. Van Arsdel, in an article on "An Extension of the Theory of Gas Absorption Towers" offers data obtained each 2 ft. up through an SO_2 absorption tower in an endeavor to show the serious errors one may fall into by using the logarithmic or arithmetic mean concentration potential in the calculation of tower or absorption coefficients.

When the solubility of a gas does not follow Henry's law it is recognized that the only justifiable use of the arithmetic or logarithmic mean concentration potential, with the *mean* value of Henry's constant, is that the precision obtained is, in many cases, well within the accuracy of the data (in Mr. Van Arsdel's illustration Henry's constant varied plus and minus 3.8 per cent from the mean value, whereas his data varied 6.7 per cent from his own curve). The justification for using such a procedure is simplicity and the uselessness of endeavoring to reach an accuracy beyond that justified by the data. Furthermore, in actual towers greater accuracy in calculation may not be required due to variation in operation (channeling, etc.).

As to whether the concentration potential may or may not be represented within the precision of the data by the arithmetic or logarithmic mean may be seen from the attached plot, giving Mr. Van Arsdel's own points. The dotted curves, which are Mr. Van Arsdel's representation of his gas and liquor analyses, are the ones he used to obtain the dotted curve for the concentration potential ($km - n$). While a number of lines may be drawn to represent data of this precision, we have drawn one other for both his gas and liquor points, the solid lines in the attached plot. These lines were so constructed that from point to point they correspond quantitatively to the arithmetic mean concentration potential expressed in Mr. Van Arsdel's units. As may be observed, Mr. Van Arsdel's points deviate more from his line than from our line—in fact, the average algebraic deviation of his points from his line is 7.2 per cent, as compared to the average algebraic deviation of his points from our line of 2.2 per cent. In fact, Mr. Van Arsdel's own data prove the advisability of using the arithmetic or logarithmic mean (as occasion demands) in the general field from which his example was chosen.



The change in the resultant curves for concentration potential up through the tower is due, of course, to the fact that each point is the result of subtracting two numbers (km and n) of similar magnitude, and a slight error in determining either one or both leads to large errors in the resulting difference. Such a method and such data cannot be used to distinguish between the different mechanisms of absorption hitherto proposed.

To the Editor of Chem. & Met.:

Sir—The writer was well aware of the lack of precision of the concentration data criticised by Dr. Haslam, and admitted in one of the introductory paragraphs that the different mechanisms of absorption so far proposed cannot be distinguished by such measurements. Indeed, there would be no point in distinguishing them technically, since they would differ by only a few per cent. The point is, however, that having settled upon any preferred mechanism of absorption, the calculations may either ignore such predictable variables as gas-volume and liquid-temperature, or they may take them into account. In the case cited, the difference amounted to 30-35 per cent. Even if the curves did not fit experimental points quite so well as some others that might be drawn, it would seem to be improper to ignore these variables when a method for evaluating their effect is available.

The experimental points, though, actually lie closer to the curve than to the straight line drawn by Dr. Haslam. As explained in the article (p. 891), the curve of solution-concentration is the only one which was drawn from the data, that for gas-concentration being calculated from the conservation-of-matter equation. The concentration of solution at the base of the tower was 5.4 grams per liter, as given in the table, not 6.4, as shown in Fig. 2. Now the average deviation of the points from the curve drawn is 0.26 gram per liter, and from Dr. Haslam's straight line 0.30 gram per liter. The agreement of the calculated curve of gas-concentration with the data is regarded as satisfactory because it passes through the five highest of the experimental points, which should be given much more weight than the lower points because of the nature of the analysis. The writer is therefore inclined to reiterate his contention that the effect of variations in gas-volume and liquid-temperature should not, and need not, be ignored unless such variations are actually very small.

The Brown Co.,
Berlin, N. H.

W. B. Van Arsdel.

Machinery and Appliances for Production and Control

Equipment News

From Maker and User

Materials and Accessories for Chemical Industries

Pump for Acids and Other Chemicals

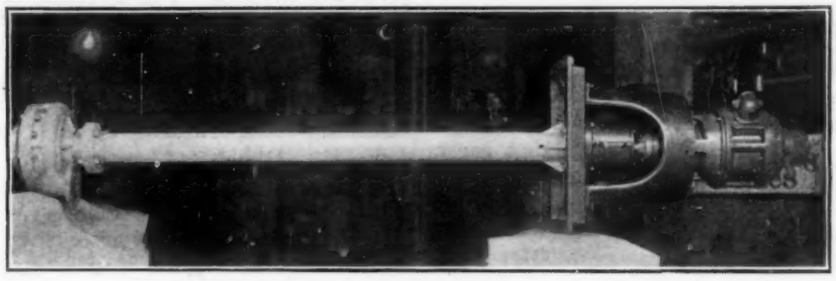
Material handling in a chemical plant is very frequently a pumping proposition, in which raw materials, intermediate materials or finished products are in a liquid form and are routed through pipe lines. Many of these liquids are of such a nature that special pumps are necessary, and for this type of handling it is quite common practice to use a centrifugal pump in which the parts touched by the liquid are of some special metal that is not acted upon by the liquid pumped.

A new pump of this type is the Koerting centrifugal acid pump, made by the Schutte & Koerting Co., Philadelphia, Pa. These pumps are made of lead, bronze, Monel, regulus or other suitable metal, depending on the materials to be pumped. They are of two types—the vertical, as shown in the illustration, and the horizontal; and in size from 1½-in. suction to 4-in. suction.

The pump is of the volute type and has an open impeller. The shaft is covered with an acid-resisting sleeve and is carried in sufficient bearings to prevent it running out of true. Ball thrust bearings are used in the vertical pump, mounted at the top of the column shown in the illustration, to carry the weight of the pump shaft. The vertical type is so designed that no stuffing boxes are needed. This type is arranged for direct-connected vertical motor drive or belt drive as desired.

The horizontal design is similar to the vertical, except that it is provided with ring-oiled bearings and has a stuffing box through which the acid-resisting sleeve on the shaft extends. This pump is also arranged for motor or belt drive as desired.

A cellulose silk company located in Pennsylvania installed the first of these pumps, which has been in operation for some time and has given excellent results. This pump is used to pump a hot solution of sulphuric acid which contains, in a saturated condition, ammonium sulphate and copper sulphate.

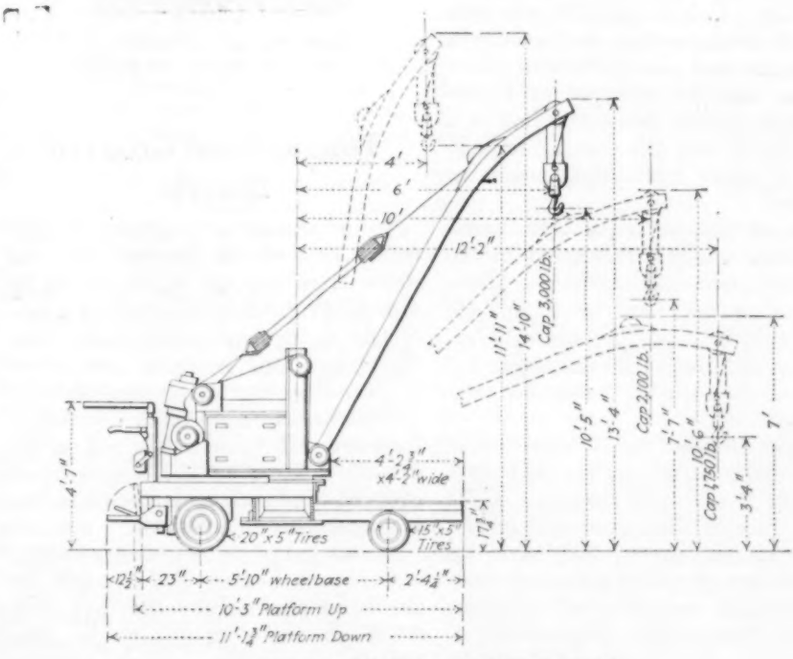


THE KOERTING CENTRIFUGAL ACID PUMP

Electric Crane Truck

The crane type of electric industrial truck is reaching a larger field than ever before among those who must transport and store kegs, barrels, drums and similar containers. The new truck of this type, called the "3-Way," recently placed on the market by the Baker R & L Co. of Cleveland, Ohio, will for this reason be of interest to many, especially those having warehousing and yard-storage problems.

The accompanying cut shows the general appearance and dimensions of the truck, together with its capacity at various radii of crane operation. The rated capacity of this truck is 3,000 lb., with which load its speed is 4½ miles per hour. The speed without load is 6 miles per hour. The speed of the crane hook is 30 ft. per minute unloaded and 7 ft. per minute loaded. In addition to the propelling motor for driving the whole machine, the crane has two motors, one for the double drum hoist which operates the hook and raises and lowers the boom, and one for the purpose of slewing the crane for picking up or placing a load at one side of the truck. The machine is fitted with many devices which insure safe operation, such as positive limit switches controlling all motions of the hoist and boom, quick break automatic switch, interlocking controller and brake pedal, and other similar items.



NEW BAKER R & L CRANE TRUCK

Acid-Resisting Fans

The removal of corrosive and harmful fumes generated in the course of various manufacturing processes is a problem often encountered. Exhaust fans of standard construction are not suited to this work, in many cases, because of excessive corrosion. Fans built of special metals are on the market, but these are often costly and, in some cases, not being as strong as if built of steel or iron, will not stand up under the service requirements.

As a means of overcoming these difficulties, the American Blower Co. is offering its standard "Sirocco" fan, the exposed parts of which are covered with an especially compounded hard rubber coating. In this way is provided a durable, comparatively inexpensive apparatus of standard design, which can be built of almost any capacity desired.

It is claimed that this coating, developed after much research, is compounded and applied to the metal in a manner to insure resistance to acid fumes, even and consistent density and adhesion to the metal. One of the principal benefits urged for the use of this coating results from the fact that any one of a number of types of fans may be used, thus saving the expense of the development charges incident to the manufacture of fans of special metals. The fan most desirable, as regards efficiency and design, for a particular requirement of volume and pressure can be obtained from the various types of fans manufactured by this company. This is not the case with fans of special metals, as the number of designs and sizes is limited.

Fans may be recoated at a considerable saving below the cost of a new fan in case the coating is damaged by some mechanical means or accident.

One of the principal advantages of rubber coating results from the fact that practically any size or shape of pipe or duct for handling acid gases may be coated. This will frequently eliminate the necessity of building the pipes or ducts of expensive materials.

Fumes Handled by Rubber-Coated Fans.—Apparatus covered with rubber will handle the following acids up to their boiling point and of the concentrations given: Sulphuric up to and including 50 per cent; sulphurous acid concentrated in fumes at room temperature; hydrochloric, 27 per cent where this acid comes 36 per cent commercial; hydrofluoric, 50 per cent; potassium hydroxide, 25 per cent; sodium hydroxide, 25 per cent; potassium dichromate, 5 per cent; acetic, 20 per cent; alcohol; acetone.

The coating will withstand a mixture of acid gas or steam in a proportion 50 per cent stronger than that given for the acid. For instance, an acid which the coating will withstand up to 50 per cent solution will be suitable for a 75 per cent mixture of gas. The rubber coating will withstand temperatures up to 175 deg. F. Oxides of nitrogen or chlorine and many other forms of nitrogen can be handled if not present in more than 2 per cent by weight. Certain other fumes may be handled by special treatment of the rubber coating.

TONGUED AND GROOVED BARREL WITH SAMPLE STAVES ABOVE

Tongued and Grooved Barrels

In an endeavor to provide a container that would prevent loss and waste from leakage, deterioration or atmospheric conditions for such materials as cement, insecticides, fine chemicals, food products and other powdered materials during storage or transit, the Associated Cooperage Industries of America has put on the market a barrel of the tongued and grooved type such as is shown in the accompanying illustration.

In this barrel the staves are raised, windlassed, heated and trussed in the usual manner and they are then fitted to their neighbors by the tongue and groove which extends from end to end of the stave. Both heads of the barrel compass the same circumference distance so that both ends of the barrel will be the same diameter. Every alternate stave is reversed, in order to improve the symmetry and give equal end dimensions.

This last-mentioned feature is accomplished automatically by the new machine which was invented for the purpose of making this barrel. This machine, it is claimed, cuts a smooth tongue and groove without tearing the wood or making rough edges. Warped or cross-grained staves do not interfere with the performance of the machine.

In presenting this barrel to the chemical trade, the Cooperage Association claims a number of advantages. Loss due to sifting is eliminated and the necessity of providing paper linings is done away with. As a further precaution for protecting the contents of the barrel silicate of soda may be applied when specified and in this case the barrel is effectually sealed and becomes an airtight package. Due to the fact that each tongue supports the bilge of the barrel, the staves are prevented from buckling when the barrel is rolled and the suitability of the barrel as a container for heavy commodities is increased. As a result of tests made on barrels of this type they are now being offered as efficient containers for shipping dry and semi-liquid commodities of many kinds met with in chemical and allied industries.

Catalogs Received

SULLIVAN MACHINERY CO., Chicago, Ill.—Bulletin 76C.—A bulletin describing the Sullivan single-drum type "HA" pneumatic hoist. Bulletin 76D. A bulletin describing the new Sullivan type "HDA" double drum pneumatic hoist.

PENNSYLVANIA CRUSHER CO., Philadelphia, Pa.—Bulletin 1005. A new catalog describing the Pennsylvania line of hammer crushers for cement rock and limestone.

EAGLE PICHER LEAD CO., Chicago, Ill.—Two leaflets, the first describing Eagle Picher Co.'s lithopone, and the second Eagle Picher Co.'s zinc oxide.

ESTERLINE-ANGUS CO., Indianapolis, Ind.—Bulletin 523. A bulletin describing the use of Esterline-Angus control instruments in coal mining.

GRAVER CORP., East Chicago, Ind.—A new booklet entitled "Zero or 1 and 1½, Which?" describing the use of the Graver hot-process water softener.

STEERE ENGINEERING CO., Detroit, Mich.—Pamphlet 248. Pamphlet on steel nozzles, manholes, door frames, etc., for gas plants.

ADAM HILGER, LTD., London, England.—A book entitled "Wave-Length Tables for Spectrum Analysis," by F. Twyman, being a compilation from recognized authorities of methods used in laboratory spectrum analysis and the tables used in connection with these methods.

CONVEYORS CORP. OF AMERICA, Chicago Ill.—A book entitled "Representative Installations," containing photographs of a number of buildings and power plants equipped with this company's steam jet ash conveyor.

Book Reviews

Chemical Engineering of Solvent Recovery

Fundamentals of the Various Phases in This Field Presented in Useful Form

By Wilbert J. Huff

The Recovery of Volatile Solvents. By *Clark Shove Robinson.* 188 pages, illustrated. The Chemical Catalog Co., New York, 1922. Price, $2.50.

In this treatise the author presents the application of the principles of chemical engineering to solvent recovery.

The first portion of the work deals with the elementary relations governing gases and vapors, vaporization, liquid mixtures, distillation, condensation and rate of reaction. These, in common with the other subject matter, are presented concisely, and are illustrated briefly by diagrams and examples. This portion of the work furnishes a refreshing review of material that is fundamental to the thorough training of all chemists and chemical engineers. Its use, unsupplemented, by those not previously trained is perhaps open to question. Unfortunately, many of the major problems in solvent recovery, such as the recovery of gasoline from natural gas or of light oil from carbonizing operations, involve the complication that the recovered solvent is not a chemical individual, but a very complex mixture, and simple relationships are, in consequence, very much obscured. Here the trained chemical engineer must proceed with the aid of a very specialized experience, preferably developing his design through appropriate small and intermediate stage experiments. For such work, the lack of a fundamental training in the theory of physical chemistry imposes a handicap that can scarcely be overcome by the brief discussion allotted here.

Chapters on adsorption follow. These deal in some detail chiefly with the design of recovery systems using silica gel, activated charcoal or similar materials. Together they present by word, diagram and curve a very good résumé of some of the work done in this interesting and still novel field. A number of references to recent literature are given, and some experimental data are included. In some respects this is the most satisfactory portion of the treatise.

The author then treats briefly solvent recovery by condensation and illustrates a few systems and a number of pieces of apparatus. Chapters on vaporization in the absence and presence of gases follow.

The thermal and mechanical relations which depend upon the character of the circulation of the gas are next discussed and a number of useful formulas included. Throughout the work, principles and formulas are illustrated by numerical examples.

Under each topic the author endeavors to present his material very briefly. This meritorious endeavor, however, may at times be attained at the sacrifice of clarity, a criticism which may perhaps be urged against certain portions of this work, as in the discussion of heat-entropy relations in the chapter upon solvent recovery by compression and cooling. It is of course exceedingly difficult to convey such concepts to a reader for whom the author may not presuppose a knowledge of the simple gas laws.

What is (to many of us at least) the most important section of the volume—namely, solvent recovery by scrubbing—is reserved for a place among the concluding chapters. In future editions the author would perhaps be justified in according this a more prominent position, and more space for the inclusion of valuable experimental data, such as, for example, that of Zeisberg on the resistance of various types of packing to gas flow. (*Chem. & Met.*, vol. 21, pp. 765-767.)

The work concludes with brief chapters on special absorbents and on extraction by solvents, and an abstract of the literature on solvent recovery. This last should prove a valuable guide.

Two phases of importance in the design and operation of solvent recovery systems—namely, the evaporation of the solvent from the material in which it is used, and the subsequent distillation of the recovered solvent to separate it from the absorbing liquid or other material—were purposely omitted from the volume for reasons explained by the author in his preface.

In future editions the value of the work would be somewhat enhanced if the author would include more direct references to the original literature in which important formulas are developed, since such inclusion will greatly aid the reader in passing to fundamentals, and also permit him to correct misprints. The danger from misprints is always inevitable, especially in first editions.

The whole work forms a contribution that merits a place on the desk of every chemist and engineer engaged in the development of solvent recovery and similar operations. The perusal of it will perhaps convince others of the necessity for submitting their problems to specialists already experienced in this field.

Tin and Tungsten

Report of the Tin and Tungsten Research Board. His Majesty's Stationery Office, London, 1922.

This is a one hundred page report of researches concerning existing methods of extraction and production of tin and tungsten in Cornwall, which covers a comprehensive description of tin ore dressing, including flow sheets of the processes. It includes the results of a number of investigators on various methods for the extraction of tungsten from tin-tungsten concentrates, such as solution of the tungsten in caustic soda solution, fusion of the ores with sodium or potassium sulphates, fusion with sodium carbonate and volatilization of the tungsten as oxychloride.

For the results of the numerous experiments recorded reference must be had to the original. C. W. Balke.

Magic and Experimental Science

History of Magic and Experimental Science During the First Thirteen Centuries of Our Era. By *Lynn Thorndike, Ph.D.*, Professor of History in Western Reserve University. Two volumes, 1,800 pages. Macmillan, $10.

This book deserves to rank with Frazer's "The Golden Bough" and White's "History of the Warfare of Science With Theology in Christendom." Like the two books cited, it is a mine of information and a source of constant astonishment to a reader.

By "magic" the author means superstitions and the "black arts" that seem so incomprehensible today that were the source of much of our modern science, since the early magicians were the first experimenters. Ideas do not die, but only change their form. Even today we are influenced by magic. Words mesmerize us, conventions of dress and etiquette prey on our minds, the charms of love and domesticity bewitch us. In the words of the author, "The life of reason is alone free of magic . . . Magic of magics, all is magic."

Some of the old superstitions that were prevalent among mankind are almost unbelievable. Pliny records that the Romans cured a cough by spitting in a frog's mouth, and cured pains in the abdomen by holding a duck against it, and cured catarrh by kissing a mule. The theory was that the disease passed to the animal. In the thirteenth century a favorite cure for disease—for example, epilepsy—consisted in whispering into the patient's right ear "Christ conquers," in his left ear "Christ reigns," and to his face "Christ commands." A medieval recipe for finding a thief consisted in repeating this incantation: "Abraham bound, Isaac held, Jacob brought back to the house." Hildegard

of Binger, a renowned scientist of the twelfth century, taught that rivers flow up hill and that a male conceived on the eighteenth day of the moon will be a thief. These superstitions are among the thousands recorded and discussed.

The book begins with the writing of Pliny on natural history and takes up chronologically the manuscript of the late Romans, the early Christians and the medieval philosophers. Many of the old manuscripts summarized have not been previously available to American readers, and the author must have spent many hours in European libraries translating Latin. Among the opinions expressed by the author are these: That Greek science has been overpraised, especially by German scholars; that medieval science was far more important than is usually believed (this agrees with such Catholic scholars as Dr. G. G. Walsh); that Roger Bacon was not so much a lone spirit struggling against ignorance and far ahead of his time as he was a typical son of the thirteenth century, superstitious and indebted to other authorities to a large degree; that Adelard of Bath is an example of many medieval wise men whose importance has been unappreciated; that strange delusions and false beliefs grow up because of man's fondness for saying sensational and exaggerated things; that men tend to repeat beliefs like parrots; that the history of thought is more unified and consistent than the fluctuations of political history; and that, as Hegel said, "Magic has existed among all peoples and at every period."

Professor Thorndike deserves the thanks of all those interested in the history of thought for this monumental and well-proportioned labor of scholarship. P. B. McDONALD.

Cellulose Research

RESEARCHES ON CELLULOSE, IV. By *Charles F. Cross* and *Charles Dorée*. 350 pp. Longmans Green & Co., London, 1921. Price, $5.

The present volume is a welcome addition to the literature on cellulose, representing, as it does, the customary review of the field, in this case the period from 1910-1921. A change in authorship has been found necessary due to the much-regretted death of Edward J. Bevan, long recognized as one of the foremost workers in this branch of science.

The subject is considered essentially from four points of view: (1) Physical properties and relationships. (2) Systematic chemistry. (3) An organic complex. (4) Cellulose industries and technology.

No attempt has been made to cover the entire subject, but the various researches which in the ripened judgment of the authors call for criticism and review are quoted either fully or in part. The great value of this criticism to the student of cellulose chemistry lies in the fact that it is based on the experience of a lifetime devoted to the study of cellulose as a natural product rather than as a structural type of chemical compound. Thus while due attention is paid to recent developments relating to the constitution of cellulose, the point is emphasized (over-emphasized, in fact) that cellulose is a "vital" product, and as such its properties cannot be brought within the range of structural formulas or defined by any strictly chemical nomenclature. Few chemists will be found to agree with this point of view. They will rather continue to hold the belief that a scientific representation of the cellulose molecule is not only possible but also that the infinite variety of subtle influences (chemical, physical, mechanical) which play such a part in making cellulose one of the most elusive chemical compounds will in the future be found capable of satisfactory explanation in the light of recognized physical and chemical laws. To aid in this accomplishment the research worker will necessarily have to be thoroughly equipped not only in organic and colloid chemistry but also in general botany and plant physiology.

The formula for lignin proposed by the authors is interesting, but unsatisfactory, in that it considers the subject too much from its wider, general aspects, and not enough from the sectional point of view—that is, one based on a series of quantitative transformations into products of well-established constitution.

The chapter on "Cellulose Industry and Technology" contains much interesting information, not the least being the description of the striking application of the hemi-celluloses to the tanning industry.

The volume will repay not only reading but careful study, both by the technical and by the scientific worker. It should serve to stimulate the imagination of both as well as to imbue the latter with a proportionate sense of humility. It is sincerely to be hoped that the authors will persist in their intention to re-edit the original volume on cellulose. HAROLD HIBBERT.

Important Articles in Current Literature

More than fifty industrial, technical or scientific periodicals and trade papers are reviewed regularly by the staff of *Chem. & Met.* The articles listed below have been selected from these publications because they represent the most conspicuous themes in contemporary literature, and consequently should be of considerable interest to our readers. A brief résumé of each article is included in the reference given. Since it is frequently impossible to prepare a satisfactory abstract of an article, this list will enable our readers to keep abreast of current literature and direct their reading to advantage. The magazines reviewed have all been received within a fortnight of our publication date.

STEAM REQUIREMENTS OF A GAS PLANT. Alan D. Whittaker. A survey and analysis of the steam consumption per 1,000 cu.ft. of gas produced. *Gas Age-Record*, June 30, 1923, pp. 817-820.

FLAME TEMPERATURES. W. Trinks. A set of graphs from which flame temperatures can be read directly. *Fuels and Furnaces*, June, 1923, pp. 65-70.

DEGREE OF DISSOCIATION AND UNSAPONIFIABLE MATTER IN ROSIN SIZE. A. Haug. A study of the fundamental relations involved in the art of rosin sizing. *Paper Trade Journal*, June 28, 1923, pp. 45-48.

RESEARCH WORK ON INDUSTRIAL OXYGEN. A discussion held at first conference of the newly formed Institution of Chemical Engineers. The experiences of British engineers in producing cheap oxygen are stressed. *Chemical Age* (London), June 16, 1923 pp. 642-646.

COAL DUST AS AN EXPLOSIVE AGENT. George S. Rice. A paper on this timely subject read before the Institution of Mining Engineers, Glasgow, June 12, 1923. *Iron and Coal Trades Review*, June 15, 1923, p, 893.

COMBUSTIBILITY OF BLAST-FURNACE COKE. Ralph A. Sherman and S. P. Kinney. Its relation to operation of the furnace and a discussion of re-oxidation theory and theory of concentration of heat. *Iron Age*, June 28, 1923, pp. 1839-1844.

THERMAL OPERATION OF MODERN REGENERATOR COKE OVENS. D. W. Wilson, H. O. Forest and C. H. Herty. Operating results and a total heat balance are given. *Amer. Gas Assoc. Monthly*, June, 1923, pp. 377-90.

TENTATIVE SPECIFICATIONS FOR GAS AND COKE COALS. Committee D-5 recommendation to A.S.T.M., as approved by A.G.A. committee on gas coal specifications. *Amer. Gas Assoc. Monthly*, June, 1923, pp. 381-2.

NATURAL AGING TESTS OF RUBBER COMPOUNDS CONTAINING ULTRA-ACCELERATORS. Carroll C. Davis. A study, especially of the deteriorating effect, of various organic accelerators upon rubber as carried out at the laboratory of the Boston Woven Hose & Rubber Co. *Rubber Age*, June 25, 1923, pp. 227-229.

COKE-OVEN GAS PLANT FOR THE MANUFACTURE OF SHEET GLASS. Hector Frud'Homme. A typical example of a plant, built in 1922, for the production of sheet glass by the Libbey-Owens process. *Fuels and Furnaces*, June, 1923, pp. 77-82.

New Publications

A REVIEW OF CHEMICAL INVESTIGATIONS IN THE DUTCH EAST INDIES. The history and present status of scientific research in the Dutch East Indies is summarized in English. A supply of this paper has been sent to the National Research Council and copies may be obtained free of charge by addressing E. W. Washburn, care of the Council, 1701 Massachusetts Ave., Washington, D. C.

STATE WATER SURVEY, Urbana, Ill., has issued Bull. 18, on "Activated Sludge Studies 1920-1922."

THE MELLON INSTITUTE OF INDUSTRIAL RESEARCH of the University of Pittsburgh has issued its Tenth Annual Report, by Edward R. Weidlein, director.

THE DOMINION BUREAU OF STATISTICS, Ottawa, Canada, has issued a pamphlet on "Chemicals and Allied Products in Canada, 1921."

NEW U. S. GEOLOGICAL SURVEY PUBLICATIONS: I: 1, Cadmium in 1922, by C. E. Siebenthal and A. Stoll (Mineral Resources of the U. S., 1922. Part I), published May 22, 1923; II: 32, Natural Gas in 1919-1921, by R. S. McBride and E. G. Sievers (Mineral Recources of the U. S., 1921, Part II), published May 22, 1923.

NEW U. S. BUREAU OF MINES PUBLICATIONS: Reports of Investigations, Serial 2476, Dangers of and Treatment for Carbon Monoxide Poisoning, by R. R. Sayers and W. P. Yant; Bull. 216, Bibliography of Petroleum and Allied Substances in 1919 and 1920, by E. H. Burroughs; Bull. 219, Explosives, Their Materials, Constitution and Analysis, by C. A. Taylor and William H. Rinkenbach.

THE NATIONAL RESEARCH COUNCIL, 1701 Massachusetts Ave., Washington, D. C., has issued Reprint and Circular Series 44, on "Fine and Research Chemicals," second revision compiled for the Committee on Research Chemicals, Division of Chemistry and Chemical Technology, by Clarence J. West, secretary of the committee. Price 50c.

THE IMPERIAL MINERAL RESOURCES BUREAU, London, England, has issued a pamphlet on Graphite (1913-1919), price 1s. 6d. net; a pamphlet on Iron and Steel (Statistics, 1919-1921), price 1s. 6d. net; and one on Copper (Statistics, 1919-1921), price 3s.

Review of Recent Patents

Many Recent Patents Deal With Heavy Chemical Production

Chamber Sulphuric Acid, Carbon Black, Ammonia Byproducts, Shell Char and Phosgene Reflect Developmental Work

THE DESIRABILITY of increasing the comparatively low concentration of sulphuric acid resulting from the ordinary chamber process has long attracted the attention of engineers. In this regard, the problem of utilization of the heat of the burner gases has been worked on to a considerable extent. Recently F. G. Stantial has been granted patent 1,457,676, issued June 5, 1923, and assigned to the Merrimac Chemical Co., in which he covers a process designed to utilize the heat of these gases for the production of more concentrated acid. To do this, he mixes the Gay-Lussac tower acid with the chamber acid and the mixture is divided between two shafts of an especially constructed Glover tower. In one of these shafts the acid is denitrated and concentrated to the desired extent for use in the Gay-Lussac tower and only the amount of gas necessary to perform this operation is passed up on this side. On the other side, down which the remainder of the acid flows and in which it becomes denitrated, the remainder of the gas is passed up in order to get the maximum possible concentration in the acid actually removed from the foot of this side of the tower.

Recovering Byproduct Ammonia as Concentrated Liquor

In byproduct coke-oven practice the amount of ammonia dropped out of the gases in the form of ammonia liquor is usually about 25 per cent of the total ammonia recovered. Generally it is desirable to keep the total amount of ammonia dropped as liquor at as low a percentage as possible. However, due to various conditions it is sometimes desirable to increase the percentage of ammonia dropped out as liquor and to recover it as a concentrated liquor. With this end in view, Leman E. Doty, of Elyria, Ohio, has taken out patent 1,457,877, issued June 5, 1923. In this process instead of returning the ammonia condensates to the flushing mixture, they are taken out of the system as they condense, and distilled into a higher concentrate. The liquor thus removed is replaced by fresh water or other absorbing fluid, which is readily vaporized by the hot gas and absorbs additional ammonia. This added fluid then condenses as ammonia liquor. It has been found that in carrying out this progress in actual practice, the ammonia recovered as concentrated liquor is increased from the usual 25 per cent of the total ammonia recovered to 40 per cent, while, of course, the yield in the form of sulphate is correspondingly reduced.

Increasing Yield of Carbon Black

Yields in the carbon black industry are such an insignificant percentage of theoretical that any method of increasing them is of interest not only as a development in technology but as a means for conserving a rapidly diminishing natural resource. Patent 1,458,351, issued June 12, 1923, to Chauncey Matlock of Brooklyn, N. Y., and assigned to Monroe-Louisiana Carbon Co., of Monroe, La., represents a step in this direction. Natural gas is burned under carefully controlled conditions so that combustion is incomplete. The hot gases carrying carbon black in suspension pass out of the combustion chambers through a cooling system and a reheater to the collector, which may be either of the electrical precipitation or closed bag filtration type. The cooling system consists of a pipe of diminishing cross-section sprayed continuously with cold water. Efficient separation of the carbon results, but the gas velocity prevents it from accumulating in the cooling zone, so that most of the carbon reaches the collector, which functions best at temperatures from 170 to 225 deg. F. The reheater serves to raise the temperature of the gases above their dew point before entering the collector.

Catalyzing Absorption of Ethylene

Absorption of ethylene by sulphuric acid, an important step in such processes as the synthesis of ethyl alcohol from coal gas, may be catalyzed through the addition of silver or silver

American Patents Issued June 26, 1923

The following numbers have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff, and those which, in our judgment, are most worthy will be published in abstract. It is recognized that we cannot always anticipate our readers' interests and accordingly this advance list is published for the benefit of those who may not care to await our judgment and synopsis.

1,459,712—Process for the Production of Basic Steel. R. Bauret, Paris, France, assignor to La Société dite: Usines Metallurgiques de la Basse-Loire, Paris, France.

1,459,732—Process for Treating Oils. G. E. Hughes, Sr., Kansas City, Mo.

1,459,733—Drier or Filler for Paints and Method of Making the Same. G. E. Hughes, Sr., Kansas City, Mo.

1,459,773—Process for Recovering the Residual Soap from Carbonate-of-Lime Sludge. P. Krebitz, Munich, Germany.

1,459,777—Process and Apparatus for the Chlorination of Methane (CH_4). R. Leiser and F. Ziffer, Vienna, Austria.

1,459,836—Filter. F. W. Manning, Brooklyn, N. Y.

1,459 852—Manufacture of Ethyl Acetate. M. Mugdan and W. Herrmann, Nuremberg, Germany, assignors to Consortium für Elektrochemische Industrie G. m. b. H., Nuremberg, Germany.

1,459,900—Method of Making Salicylates. M. E. Putnam and J. McCreadie, Midland, Mich., assignors to Dow Chemical Co., Midland, Mich., a corporation of Michigan.

1,459,910—Method of Removing Rust from Metal Articles. J. S. Gravely, Wytheville, Va., assignor to Winchester Repeating Arms Co., New Haven, Conn.

1,459 911—Filter Press. A. McD. Gray, Elizabeth, N. J., assignor to M. W. Kellogg Co., New York.

1,459,912—Drying Machine. G. Ianieri, Philadelphia, Pa.

1,459,921-2—Method of and Apparatus for the Hydrodynamic Separation of Particles. T. Nagel, Brooklyn, N. Y.

1,459,923—Method of and Apparatus for Treating Material with Gas. T. Nagel, Brooklyn, N. Y.

1,459,932—Process of Heat Treatment. E. Stansfield, Ottawa, Ont., Canada.

1,459,959—Process for the Acceleration of Propionic Fermentation. J. M. Sherman, Washington, D. C., and R. H. Shaw, Chicago, Ill.; dedicated, by mesne assignments, to the People of the United States.

1,460,012—Method of Preparing Colloidal Metals and Metalloids and Compounds of Same. L. Berend, Amoneburg, Biebrich-on-the-Rhine, Germany.

1,460,024—Apparatus for the Semi-Coking of Coal, Slate or Other Bituminous Substances. K. P. zu Löwenstein, Berlin, Germany.

1,460,026—Salt Press. J. P. Madden, Bethlehem, Pa., assignor to Bethlehem Steel Co., Bethlehem, Pa.

1,460,044-5—Method of and Apparatus for Compressing Fluid. R. Suczek, Philadelphia, Pa., assignor to C. H. Wheeler Manufacturing Company, Philadelphia, Pa.

1,460,065—Blast Furnace. J. Kennedy, Pittsburgh, Pa.

1,460,067—Coke-Discharging Apparatus. W. G. Laird, New York, assignor to Henry L. Doherty, New York.

1,460 106—Electric-Furnace Melting of Manganese Scrap. W. G. Nichols, Chicago, Ill., assignor to American Manganese Steel Co. Chicago.

1,460,110—Process for Recovering Catalyst from Catalysis Residue. E. V. Owen, Chicago, Ill., assignor to Hoover Co., Chicago.

1,460 180—Process for Converting the Carbonates or Sulphides of Barium or Strontium Into the Corresponding Hydrates. R. W. Shafor, Denver, Colo.

1,460,244—Process for the Manufacture or Formaldehyde. A. Heinemann, Berlin-Tempelhof, Germany.

1,460,251—Waterproofing Composition and Method of Making the Same. G. W. Kramer, Chicago, Ill.

1,460 285—Method and Apparatus for Drawing Glass Cylinders. T. Stenhouse, Washington, Pa., assignor, by direct and mesne assignments, of one-sixth to A. L. D. D'Adrian, Washington, Pa., and one-sixth to B. F. Drakenfeld, Jr., New York.

1,460 315—Dyestuffs of the Triarylmethane Series and Process of Making Same. G. de Montmollin, J. Spieler, and G. Bonhôte, Basel, Switzerland, assignors to Society of Chemical Industry in Basle, Basel, Switzerland.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

compounds to the acid, according to patent 1,458,646, issued June 12, 1923, to R. Engelhardt, W. Lommel and A. Ossenbeck and assigned to Farbenfabriken vorm. Friedr. Bayer & Co. While for instance 100 volumes of ethylene are absorbed in sulphuric acid (96 per cent) in a certain time, 1,300 volumes are absorbed in the same time when 0.1 to 0.2 per cent of silver sulphate is added to the sulphuric acid. The rapidity of this absorption can be increased still more by raising the temperature or by the addition of a small quantity of substances furnishing a foam or emulsion with sulphuric acid, such as oils or liquid hydrocarbons —for instance, olive oil, castor oil, rapeseed oil, turkey-red oil, chloroform, carbon tetrachloride, tetraline, (tetrahydronaphthalene), carbon bisulphide, stearic acid or the like.

Shell Char on Large Scale

It has been found that shells and fruit pits yield both a grade of charcoal and also certain byproducts that are commercially desirable. In the past most of the work of development in the production of these materials has been done on small-scale apparatus. Stanley Hiller recently obtained patent 1,458,410, issued June 12, 1923, and assigned to Pacific Byproducts Co., of San Jose, Calif., in which he describes large-scale apparatus for the continuous carrying out of the operation of manufacture of charcoal from these raw materials. Essentially his apparatus consists of a rotating drum which is partly heated by the combustion of the gases given off by the burning pits. The initial firing is carried out by means of liquid fuel. The drum is fitted with air-conditioning apparatus, control valves and with constant feed mechanism and means for removing the charcoal as formed at the opposite end of the drum.

Precipitating Barium Sulphate With Niter Cake

In the manufacture of high-grade precipitated barium sulphate by the interaction of solutions of barium sulphide and sodium sulphate, a reduction in cost of production would result if niter cake could be used to replace the salt cake commonly used as a source of sodium sulphate. A promising solution is offered by James B. Pierce, Jr., of Charleston, W. Va., in patent 1,457,934, issued June 5, 1923. Niter cake is neutralized with sodium sulphide solution and the liberated hydrogen sulphide is absorbed in sodium sulphide solution to give sodium hydrosulphide which forms the secondary product instead of the usual sodium sulphide.

$$2\,BaS + 2\,Na_2SO_4 = 2\,BaSO_4 + 2\,Na_2S$$
$$Na_2S + 2\,NaHSO_4 = H_2S + 2\,Na_2SO_4$$
$$Na_2S + H_2S = 2NaHS$$

Neutralization of the niter cake has the added advantage of precipitating iron as sulphide so that the resulting sodium sulphate solution is pure enough to produce high-grade blanc fixe.

Phosgene Developments Continue

With the war over, developments in phosgene manufacture continue. D. B. Bradner, of Edgewood, Md., in patent 1,457,493, issued June 5, 1923, explains a process whereby it is possible to use other than pure materials in the manufacture of this gas. By the burning of coke or similar material under special control he obtains a gas consisting of roughly 27 per cent CO, 5 per cent CO_2 and 68 per cent N. This gas mixture is dried by such a dehydrating agent as sulphuric acid and is then mixed with the theoretical amount of chlorine. Bone black or sunlight may be employed as a catalyst. In the resulting mixture phosgene is separated from inert and undesired gases by passing through silica gel or activated carbon. Phosgene recovered from the absorbent may be liquefied in the usual manner.

Calendar

AMERICAN CERAMIC SOCIETY, summer meeting, Toledo, Detroit and vicinity, Aug. 8 to 11.

AMERICAN CHEMICAL SOCIETY, fall meeting, Milwaukee, Wis., Sept. 10 to 14.

AMERICAN ELECTROCHEMICAL SOCIETY, forty-fourth meeting, Dayton, Ohio, Sept. 27 to 29.

AMERICAN GAS ASSOCIATION, annual convention, Atlantic City, Oct. 15 to 20.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, INC., Ontario and Quebec, Aug. 20 to 31.

AMERICAN MINING CONGRESS, Milwaukee, Wis., Sept. 24 to 27.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS, iron and steel exposition, Buffalo, N. Y., Sept. 24 to 28.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES (NINTH), New York, Sept. 17-22.

NATIONAL SAFETY COUNCIL, twelfth annual safety convention, Statler Hotel, Buffalo, Oct. 1 to 5.

Men in the Profession

C. H. BOOTH has been elected president of the recently organized Republic Rubber Co., Youngstown, Ohio.

LAWRENCE H. BROWN, ceramic engineer, has resigned from the Edwin M. Knowles China Co., East Liverpool, Ohio, to become associated in a similar capacity with the Findlay Electrical Porcelain Co., Findlay, Ohio, in its research department.

RANDOLPH CATLIN has been elected secretary and treasurer of the American Cotton Oil Co., New York, succeeding W. S. REED in the last-noted capacity.

F. JULIUS FOHS, geologist and vice-president of the Humphreys Oil Co., Dallas, Tex., has completed a survey of the oilfields of California, made to determine the advisability of his company entering into development work in that territory.

Dr. HAROLD HIBBERT, associate professor of applied chemistry at Yale University, is in England now and expects to visit a number of prominent cellulose chemists in Europe. He will also attend the International Union of Pure and Applied Science and the meetings of the Society of Chemical Industry.

F. A. MARSELLUS has been elected treasurer of the Tide Water Oil Co., New York.

F. W. B. SCHORADT has taken over the management of the Florence plant of the U. S. Potash Corporation, at Marysville, Utah.

W. N. WATSON, color specialist of the Chemical Section of the Tariff Commission and acting chief of the section in the absence of C. R. DeLong, who is conducting cost investigations in Europe, left June 30 on a 6 weeks' leave of absence which he will spend in New England. DEXTER NORTH will be in charge of the Chemical Section until Chief DeLong returns, which will be in August, as his stay in Europe has been prolonged a month by the commission because of additional work assigned him there.

J. ALEXANDER WILSON, manager of the pyroxylin division of the Duratex Corporation, has resigned to take charge of the pyroxylin department of the Beckwith Chandler Company, of Newark, N. J.

Dr. VICTOR YNGVE, formerly fellow in Cryogenic Laboratory at Harvard, has accepted a position as director of research for the Manhattan Electrical Supply Co., New York City.

Obituary

ARTHUR T. BEACH, president of the Beach-Russ Co., New York, and also president of the Abbe Engineering Co., N. Y., died at his home in Brooklyn, N. Y., June 16, in his sixty-first year. His death was due to heart trouble and was hastened by the death of his wife, which occurred just one month prior, on May 16.

HORACE DE LISSER, founder and chairman of the board of the Ajax Rubber Co., Trenton, N. J., died at his home in New York, June 27, after a brief illness resulting from a nervous breakdown. He was born in Jamaica, B. W. I., 1866, and founded the Ajax Co. in 1896. He is survived by his wife.

Industry and Trade

Current News and Market Developments

Summary of the Week

Production of coal-tar from byproduct coke during 1922 was the largest in history of the industry.

Chemical Division of Department of Commerce plans studies of conditions in countries to which we do not export.

Application of renewal for 1924 of permits for handling alcohol must be filed during July and August.

Palmer and Garvan present testimony in trial at Wilmington, showing motives in Chemical Foundation formation.

Leading producers of tin crystals and bichloride of tin announce lower price schedules for these chemicals.

Efforts to form a coal-tar export association apparently have failed.

Germans, considering erection of chemical plants in this country, may decide to build in the Orient.

Imports of coal-tar dyes and chemicals through port of New York in June were 261,869 lb., valued at $292,340.

Domestic production of dyes in 1922 registered a gain of 66 per cent over the output of 1921.

New methods of extracting chloride of ammonia are being adopted in Germany.

Declines in the lead market have been followed by a drop of one-half cent per lb. in the lead pigments.

The Undeveloped Market for Calcium Arsenate

A VERY INTERESTING PAMPHLET by B. R. Coad and T. P. Cassidy of the Bureau of Entomology has been issued by the U. S. Department of Agriculture. The pamphlet is entitled "Dusting for the Cotton Boll Weevil" and it is primarily intended to educate the cotton grower in the advantages of using calcium arsenate as a weapon of defence against the ravages of the boll weevil.

In giving instructions for dusting, the pamphlet states that about 5 to 7 lb. of calcium arsenate per acre should be used at each application and three applications at the rate of 1 every 4 days are recommended. Further applications are advised if the weevil is not then under control.

Producers and distributors of calcium arsenate may find in these figures a basis for determining the potential market for the sale of their goods. The area planted to cotton this year is estimated in excess of 38,000,000 acres. Just what percentage of this total will be infested with the weevil is a matter of conjecture, but if an average of 15 lb. of calcium arsenate per acre actually was used in the acreage where dusting was needed, it is evident that consumption of arsenate would be many times larger than now is the case.

The experts of the Bureau of Entomology partially explain the comparatively small use of calcium arsenate by reference to unfavorable results that have followed improper use of the poison. They state that a survey of the poisoning by farmers in previous years shows that an unfortunately large proportion were not properly informed as to the conditions under which they should poison and the methods they should pursue. As a result there were many unnecessary failures. If better results are to be secured in the future, the operation must be more thoroughly understood.

Naturally many planters who have tried out applications of arsenate with unsatisfactory results would not be easily influenced to continue along those lines. However, it is a matter of record that where the proper method of handling is followed, results from the use of calcium arsenate have been highly remunerative to the cotton grower. The general gains from weevil dusting, as pointed out by Messrs. Coad and Cassidy, under average, fairly favorable conditions, seem to be from 200 to 400 lb. of seed cotton per acre. Given the price of seed cotton, this gain in production may be reduced to a dollars and cents basis and thus offer irrefutable proof that calcium arsenate used by the cotton grower represents an investment and not an expense.

Bureau of Entomology pamphlet aims to educate the cotton grower as to advantages of using calcium arsenate against the boll weevil. Gains in crop attributed to weevil dusting claimed to be 200 to 400 lb. of seed cotton per acre. Earlier and more uniform distribution of arsenate throughout the season is advocated.

In view of the increased acreage returns where dusting has been properly done, it is evident that the comparatively small consumption of calcium arsenate in the cotton fields cannot be attributed to unsatisfactory results in previous seasons. Wide publicity through government and other channels undoubtedly has acquainted the majority of cotton growers with the value of dusting as a preventive against weevil damage. This has resulted in a larger use of weevil poisons, but members of the trade contend this increase has not been so rapid as might be expected where paying results were so apparent.

Some members of the trade, including men who are familiar with the peculiarities of the Southern buyer, have advanced the opinion that methods of marketing calcium arsenate could be improved with beneficial results to the industry. It is held that under present methods too much is expected from last-minute demands, with positive losses from weevil activity as the spur to consuming demand. This crowds an active trading movement into a short period, places manufacturers at a disadvantage, and invites meteoric fluctuations in market prices.

As an aid to an earlier and more uniform distribution of arsenate throughout the season, it is suggested that greater use be made of the small distributors at local points in consuming centers. It is pointed out that the Southern planter, as a rule, does not buy, but must be sold, and the one best suited to do the selling is the person with whom the buyer comes into physical contact. This psychological aspect of the trade may or may not be important, but it may point the way to careful study of the marketing problem.

Domestic Production of Dyes in 1922 Reached Total of 64,632,187 Lb.

Represents Increase of 66 Per Cent Over 1921 Totals—Vat and Alizarin Dyes Make Gains—Many New Dyes Produced

THE "Census of Dyes and other Synthetic Organic Chemicals" prepared by the United States Tariff Commission will be ready for distribution this month. The census figures show that the domestic production of dyes in 1922 by eighty-seven firms was 64,632,187 lb., an increase of 66 per cent over that of 1921. The sales for 1922 totaled 69,107,105 lb., valued at $41,463,790. The size of the industry in 1922 is in sharp contrast with that of 1914, when only seven firms manufactured a total of 6,619,729 lb., valued at $2,470,096. The dye industry in that period was in no sense a self-contained one, as the dyes produced were made almost entirely of intermediates imported chiefly from Germany. The increase in dye production during 1922 was largely due to an increase in general business activity. In June the textile and other dye-consuming industries became more active and during the remaining months of the year the demand for dyes steadily increased.

Average Sales Price Lower

The average sales price of all domestic dyes for 1922 was 60c. per pound, compared with 83c. in 1921 and $1.26 per pound in 1917. The 1922 figures represent a 28 per cent decline from that of 1921. There were price reductions for both the bulk colors and dyes consumed in smaller quantities. The average price of indigo in 1921 was 45c. per pound, compared with 24c. in 1922, a 47 per cent decrease. Direct black EW declined 47 per cent; acid black, 28 per cent; salicine black U, 27 per cent; alizarin, 20 per cent; alizarin saphirol B, 34 per cent; wool green S, 41 per cent; indanthrene blue GCD, 30 per cent and eosine, 24 per cent.

One of the conspicuous developments of the year 1922 was the increased production of vat and alizarin dyes. The vat dyes are used in cotton dyeing and printing for the production of shades of remarkable fastness which are not destroyed by the modern laundry treatment. These colors are of great complexity and have presented serious difficulties in their commercial production. Their use is on the increase, as the public is beginning to recognize that fast shades are obtainable on cotton goods. The alizarin dyes are of great value in wool dyeing and the addition to this field of new dyes and the increased production of other dyes is a significant step in the development of a self-contained dye industry. The total production of vat dyes, (not including indigo) was 1,075,992 lb. in 1922, compared with 345,152 lb. in 1921. The production of the anthraquinone dyes, which includes alizarin dyes and a large part of the vat dyes, was 1,234,963 lb.

Many important dyes were produced for the first time on a commercial scale in 1922. These comprise colors of great value for the dyeing of either silk, cotton or wool, such as vat dyes, alizarin, developed cotton dyes, mordant and acid dyes. The increased production of these colors is reflected in a reduction of these imports. The production of these dyes in the United States has resulted only after large expenditures on research and most painstaking investigations. There are still gaps in our manufacturing program which should be filled to make a self-contained dye industry. These comprise certain of the vat dyes, together with certain of the mordant, acid and direct dyes.

American Quality High

The satisfactory quality and the uniform standardization of the American dyes is one of the striking evidences of the commendable progress made by the industry. Dye for dye, with relatively few exceptions, the domestic products are found equal to the pre-war German dyes. In the early stages of the domestic dye industry, after the outbreak of the Great War, many of our dyes were lacking in uniformity of strength and quality. This condition, however, no longer prevails, as our domestic manufacturers are marketing dyes which are uniformly standardized as to strength and quality. Statements of the largest silk and woolen manufacturers and also from cotton printers and dyers agree as to the satisfactory results obtained from American dyes.

The United States produces about 93.55 per cent of the dyes actually consumed. The imports of dyes in 1922 totaled 3,982,631 lb., the production was 64,632,187 lb., and the export totaled 6,956,593 lb. Consumption is assumed to equal production, plus imports, minus exports, or 61,658,225 lb. The imports in 1922 were 6.2 per cent of our total production and 6.5 per cent of our consumption. In 1914 the imports were nearly 90 per cent of our consumption.

Production of dyes in 1922 grouped by classes according to their method of application on fibers were as follows:

	Lb.
Acid	9,380,014
Basic dyes	2,937,585
Direct cotton dyes	11,931,737
Lake and spirit-soluble dyes	1,009,512
Mordant and chrome dyes	3,749,701
Sulphur dyes	16,913,767
Vat dyes (not including indigo)	1,075,992
Indigo	15,850,752
Unclassified dyes	1,283,127

Other Coal-Tar Products

The total output of dyes and other finished coal-tar chemicals in 1922 by 164 firms was 88,368,131 lb., compared with 51,457,565 lb. by 147 firms in 1921. The 1922 figure represents a 72 per cent increase over that of the previous year.

Color Lakes — A total production of color lakes by 43 firms in 1922 was 10,578,664 lb., compared with 6,152,187 lb. in 1921.

Photographic Chemicals — The production by 7 firms of those coal-tar products used as photographic developers totaled in 1922, 345,798 lb., as compared with 183,798 lb. in 1921.

Medicinals Show Large Increase — This class of coal-tar products may be considered one of the most important, as they are essential to the nation's welfare. The total production of synthetic medicinals of coal-tar origin for 1922 was 2,946,347 lb., compared with 1,545,917 lb. in 1921.

Perfumes and Flavors—The total production of flavors of 20 firms for 1922 was 1,215,668 lb. and the total output of 17 firms making perfumes for 1922 was 793,148 lb., compared with 119,335. lb.

Synthetic Phenolic Resins — These products are used as substitutes for amber in the making of pipe stems and similar articles, and in the manufacture of varnishes and lacquers. They also find a large consumption in the manufacture of electric insulators. The production for 1922 by 5 firms was 5,944,133 lb.

Synthetic Tanning Materials — The production of these products in 1922 by 4 firms amounted to 1,910,519 lb., a slight increase over that of 1921. These products are of interest, as our domestic supply of tanning barks is rapidly decreasing and we are largely dependent upon important natural tanning materials for our tanning industry. Synthetic tanning materials are of comparatively recent origin and these products have considerable promise for further development.

There was a large increase in the production of tricresyl phosphate, which is used as a substitute for camphor in the manufacture of pyroxylin plastics. Although these products are not used to replace camphor for all purposes in this industry, their future development by the coal-tar industry will overcome, at least to some extent, the monopoly on camphor which Japan has held in the past.

Record Coal-Tar Output

Preliminary figures of the Geological Survey indicate that the production of coal tar and byproducts from the by-product coke industry during the year 1922 was the greatest in the history of the industry. Production of the byproduct coke was about 28½ million tons, which exceeded the production of both beehive and byproduct coke during the previous year. The replacement of beehive ovens by the byproduct coke ovens, which recover the tar, ammonia and gas products entirely lost in the old type of beehive ovens, is of great economic significance in the conservation of our natural resources, for (1) the byproduct ovens increase the production of ammonia for fertilizer and other uses; (2) the gas produced in these ovens is used for lighting and industrial heating; and (3) the tar serves as a basis for the

domestic coal-tar dye and chemical industry, and yields motor fuel, solvents and road pitches.

The production of tar is greatly in excess of the requirements of the dye and coal-tar chemical industries. A large amount of the tar is burned and of the remaining portion refined, only a part is purified to such final products as benzene, toluene, naphthalene and anthracene, owing to the strong demand for partly refined products, motor fuel, solvents, soft pitches and the like.

Conspicuous progress has been made within the past few years in the development and manufacture of synthetic organic chemicals not of coal-tar origin. These include acids, alcohols, esters, ketones, aldehydes, etc., which are used as medicinals, solvents, perfumes, flavors and in many industrial and other processes. This field holds high promise of further expansion and it is expected that many new products of great economic value will be manufactured and placed on the market. The production of synthetic organic chemicals, other than those derived from coal tar, during 1922 was 79,202,155 lb.; the production in 1921 totaled 21,545,186.

Exposition Exhibitors Vote on Suggested Changes

At a meeting of Chemical Exposition exhibitors which was held on June 28 at the Chemists' Club, New York, several questions of importance were passed upon. A vote was taken of those present to ascertain how many would prefer a biennial to an annual show. The count showed an even split on the question. Because only about 25 per cent of the exhibitors were present it was decided to send out a questionnaire by mail.

Holding the exposition every 18 months in New York instead of annually as at present was voted down decidedly. In the same way the suggestion to hold the exposition every third year in Chicago was floored.

The question of advisability of allowing foreign exhibits to be presented was discussed. A vote indicated a large majority against the showing of products from Europe. Goods from Canada, however, were not excluded by this decision. Appeals by Dr. L. H. Baekeland and Dr. Charles H. Herty, chairman of the advisory committee of the exposition, in favor of a national exposition rather than an international one, helped to swing the vote in favor of the American manufacturer. As a result of this decision no chemical, dyestuffs, equipment, instruments or related products of foreign origin will be shown at the exposition with the possible exception of special cases which will be taken up by the advisory committee.

For the benefit of the six members who are part of the advisory committee of the exposition, the Chemical Equipment Association conducted a special questionnaire. The results of this indicated a belief on the part of most members that present conditions in the industry are such that there is considerable reason for a biennial rather than an annual exposition.

Pulpwood Embargo Looms

Canadian House of Commons Passes Measure to Restrict Exportation of This Commodity

A resolution giving power to the Canadian Government to make regulations prohibiting the export of pulpwood from Canada has been carried in the House of Commons. This does not mean immediate action; the government is merely seeking authority to prohibit exports if and when it is considered opportune.

The resolution is thought in Canada to mark the end of a movement that has long sought such a step and that, through tremendous forest losses, has gained strength and intensity during recent months.

Justification for the prohibition of the export of Canadian pulpwood is found by its advocates in the fact that millions of dollars worth of this product is being annually sent across the border, drawn from a supply that is none too much for Canada's own needs. The embargo would mean that United States mills must either buy manufactured pulp or transfer their plants to Canada.

The opponents of the measure, however, point out that the prohibition of pulpwood exports would work injury to many settlers and owners that now depend for a livelihood upon outside demand for their raw timber. They claim there is also the inherent objection to all measures that restrict trade by the erection of artificial barriers. And although the strongest advocates of the embargo discount the matter, those in opposition point to the danger of retaliatory prohibitions by the United States.

Mines Bureau Offers Films

Eighty different industrial motion picture films, valued at nearly $200,000, are now in the possession of the Department of the Interior, Bureau of Mines. These motion picture films were produced at small cost to the government, practically the entire cost being borne by the various industries filmed. Each film depicts the various processes employed in the manufacture and marketing of some well-known American product wholly or partly of mineral origin. The films are loaned free by the Department of the Interior to technical societies, commercial organizations, colleges, schools and churches, and are in constant demand.

Ford to Make Coke in Canada

A factory for the low-temperature distillation of coal by which a ton of coal is expected to yield as high as 10 gal. of motor fuel as a byproduct, is under construction at the Ford factory at Walkerville, Ont. According to an announcement of the president of the Ford Motor Co. of Canada, the factory, which will cost in the neighborhood of $500,000, will distill about 400 tons of coal per day. Should the experimental factory prove successful, other factories will be constructed by the Ford company.

American Electroplaters Hold Annual Meeting

With approximately 150 delegates present from all sections of the country, the annual meeting of the American Electroplaters Society was held at the Biltmore, Providence, R. I., from July 2 to 5.

Following the first day of the convention, when addresses of welcome were heard, a general session was held. Past presidents and various other officers presented matters of general interest to the gathering. On Tuesday an all-day holiday was declared, with a trip to Newport and a sail on Narragansett Bay. This day was followed by an evening of telling technical stories of special appeal to foremen.

Wednesday, the Fourth, marked the beginning of the real technical session. Walter Fraine, past president, opened the morning meeting with a thorough discussion of "Qualities Necessary in a Progressive Foreman." In his talk he emphasized the two primary abilities, that of leading and that of teaching. Aggressive policies, tempered by judgment and sound knowledge of modern developments in the industry, were pointed out to be highly desirable. The various phases of working industrial psychology were likewise enlarged upon by Mr. Fraine.

Several papers having to do with plating, especially nickel plating, were read and discussed. C. H. Proctor showed the increasing need of standards and of education, both of the industry and of the people in accepting and adopting them. The subject of replating nickel-plated ware was taken up in a general manner. One successful method consists in carrying out the operation by cleaning, coppering, removing the copper in a brass dip, recoppering and then nickeling as usual.

Frank J. Clark explained the process of preparing the plates from which phonograph records are made. The original wax impression, covered with graphite, is plated lightly with copper, then a heavier coat is applied. A thin layer of silver followed by painting with iodine makes it possible to continue the plating and to obtain a plate with the same impression as the original wax record had. The layer of silver iodide formed makes the separation of the desired plate from that of opposite impression possible.

Zinc plating or galvanizing with the addition of cadmium hydroxide and mercury was explained by Dr. Werner. He pointed out the results of experiments which indicate that plating in this fashion results in the imparting of superior properties, especially in increasing the difficulty of corrosion.

Several brief papers were read by various members having to do with improvement of plating control. In this connection William Blum and H. E. Haring discussed "Throwing Power" and L. W. Graham outlined the general problem of "Generation, Distribution and Control of the Current in the Plating Room."

Palmer and Garvan Defend Formation of Chemical Foundation

Evidence Introduced During Week to Show Constructive Work of Foundation as Well as Financial Losses Which It Has Undergone

THAT PRESIDENT WILSON fully understood the chemical and dyestuff situation and recognized all the factors involved when he authorized the sale of 4,800 patents to the Chemical Foundation has been the contention of the defence during the past week at the trial being held at Wilmington, Del. The evidence of A. Mitchell Palmer and that of Francis P. Garvan, head of the Foundation, has been presented in this connection. Garvan has also testified that the Foundation has suffered a loss of close to $150,000 since 1919. Due to 2 days during the week when the court has not held sessions, less testimony has been presented than during the week previous. Herman A. Metz has protested that certain of the statements he made in court 2 weeks ago have been greatly misconstrued by the press.

In the course of the testimony which Palmer has presented during the week, he has asserted that the details of the organization of the Chemical Foundation were developed by Messrs. Choate, Hoguet and Garvan, on broad lines suggested by himself. According to him, President Wilson's study of chemical conditions abroad had produced a thorough appreciation that Germany's chemical industry was at the base of her war munitions program. This conclusion was a moving factor in inducing his conclusion that America's duty was to seize German-owned chemical and dye patents in this country and to prevent a recurrence after the war of Germany's monopoly.

Mr. Palmer recounted in detail a conversation with President Wilson and another with Mr. Polk in which the program leading to incorporation of the Foundation was gone into fully. He cited his reasons for the alleged small cash consideration, saying the conditions of the sale made the payment of minor consequence, and declared that a private sale was necessary to prevent an American monopoly replacing a German monopoly and to make impossible the return of the patents to Germany by an individual making the highest bid at public auction.

At the conclusion of his testimony the government allowed Palmer to step from the stand without any cross-examination. A legal skirmish ensued, however, in which Colonel Anderson objected to Mr. Palmer's testimony as to the information which he possessed. In this connection Judge Morris asked:

"If this witness, knowing the facts which he has stated that he does know or did know, was the moving spirit in the consummation of this transaction, and in so doing became a party to the conspiracy, is there any escape from the conclusion that he was the most guilty participant in the transaction, those greater interested in the dye and chemical industry not excluded? And if that conclusion of mine be any degree sound, is it proper to deprive this witness, although not a party defendant, of the opportunity of disclosing in full measure the information upon which he acted?"

According to Colonel Anderson legal fraud was involved in the transfer. He states:

"I have always taken the view that actual fraud is a matter which must be drawn from the entire record, be argued before the court upon the entire record and should be very carefully avoided in the presentation of a case where only the facts should be proved, and let the court draw its conclusions. Because fraud, of course, is a conclusion from facts proved, and not a fact. . . .

"It is my view that the distinguished gentleman who is now on the witness stand entirely misconceived the meaning of this law and his duties thereunder. I say that with great respect for his views, but I think so, and that the government was probably acting upon a wrong theory of this statute. If that is true, it is perfectly proper for us to bring it to the court's attention."

It was expressly ruled by the court that the evidence introduced by Palmer be accepted purely as bearing on the questions of knowledge and conspiracy and not as proof of the truth of statements quoted by the witness.

Francis P. Garvan Takes Stand

In the course of his evidence Garvan pointed out that the Chemical Foundation is not concerned with profits and that its motives are altruistic. As substantiation of these points he declared that the Foundation has spent large sums of money in distributing literature in America relevant to the place which chemistry and the chemical industry holds in national life. The figures presented by him indicate a net deficit of $147,681 for the Foundation since 1919.

Like A. Mitchell Palmer, his predecessor as Custodian, Mr. Garvan endeavored to justify the sale price as being all that could be obtained, in view of the restriction imposed. He testified further that President Wilson had given warning that the sale of the patents must be such that no monopoly would result. As evidence of his knowledge of the facts surrounding the German industry Mr. Garvan said:

"The information I had was that prior to 1914 Germany had agencies here which represented the six companies, commonly called the Big Six, which had control of the chemical industry of Germany. My opinion was that those six companies had been combined into a coalition and that they controlled the entire organic chemical industry of Germany; that the agencies here had no independent existence of their own, but were the servants of the German industry; that the German industry had a monopoly of the American organic chemical industry, particularly as to dyes; that there were here nothing but three or four assembling plants which were dependent entirely upon the intermediates which they, in turn, got from the six German companies in Germany.

"My information showed that, whereas in America we had absolutely no understanding of the relation of organic chemistry to industry or to national defence, or to the progress in medicine, each and every one of the Germans with whom I came in contact had a complete understanding that it was the lifeblood of modern industry, that it was the foundation of modern war, and that it was the hope of future medical development; that they were brought to regard that as the special province and special asset of Germany."

He said it was in keeping with his knowledge of these facts that he advised with Palmer with regard to the Foundation and that it was likewise in keeping with President Wilson's insistence that no monopoly should be tolerated that the steps were taken which lead up to the organization of the Foundation.

Bibliography Compilers Seek Assistance

Two years ago the Research Information Service of the National Research Council enlisted the help of several men in the preparation of a key to scientific bibliographies, each man undertaking to prepare the work in his respective science. The bibliography of bibliographies on geology is now in press and active work is under way in those for chemistry and chemical technology, astronomy and physics.

In the field of chemistry and chemical technology, about 6,000 references have already been collected, including separate bibliographies, lists of references appended to articles or books and comprehensive reviews of the literature. This field is so wide and the subjects covered so numerous that the co-operation of the specialists in the various branches is sought by the compilers. The request is made that those who have references to bibliographies in any special field facilitate the completion of this work by sending such references to the compiler of the bibliography of bibliographies in chemistry and chemical technology at the National Research Council. Any annotation made on the completeness or value of the references will be appreciated.

Work is being pushed toward the early publication of this bibliography, at which time notices will appear in all the scientific and technical journals in order that those interested may secure copies.

Survey Indicates Adequate Sources of Supply for Divi-Divi

Output Can Be Increased to Meet Demands—Venezuela Largest Producing Country—Prices Tending Toward Pre-War Levels

A SURVEY of the divi-divi industry completed by H. M. Hoar, of the Research Division of the Department of Commerce, reveals that different countries of tropical America are producers of this commodity. The report states that divi-divi was used in the manufacture of leather by the Spaniards as far back as 1769, but it was not until 1915, when tanners found it necessary to utilize all available sources of tannin to meet the war demand for leather, that the use of divi-divi in the United States could be regarded as worth while. In that year imports into this country were fourteen times as great as the pre-war level, advancing to fifty-two times that amount in 1916, and attaining the peak in 1919, when statistics showed that imports increased to ninety times the 1913 receipts. The domestic consumption of divi-divi in 1919 (the latest year for which statistics are available) amounted to 4,985 tons of pods, valued at $381,689, and 12,772,793 lb. of extract, valued at $511,794.

Venezuela has long been regarded as the world's most important source of divi-divi. During the period 1908-21 Venezuela's exports of divi-divi averaged 6,610 metric tons annually. This average includes yearly exports as high as 10,902 tons in 1911 and as low as 3,956 tons in 1920 and 2,849 tons in 1921; omitting the two low years, the average of the preceding 12 years was 7,145 metric tons. Should a greater demand for this product be created among tanners, Venezuela could increase its output several fold through harvesting of full crop and systematic cultivation.

U. S. the Principal Buyer

Before the war, Germany was Venezuela's best market for divi-divi, which is utilized as both tanning agent and dyestuff. Out of a total of 5,371 metric tons exported by Venezuela in 1913 Germany took 5,092 tons. Since 1915, however, the United States has become the principal purchaser. The January-April, 1923, imports of divi-divi into the United States aggregated 3,800,982 lb., of which Venezuela furnished 2,116,392 lb., or 56 per cent.

The high cost of transportation during the war and the desire to eliminate all possibility of waste led to the establishment of two extract factories in Venezuela, located at the ports of Porlamar and La Guaira. At each of these plants the pure tannin is extracted from the pods—by means of a patented process into which neither heat nor the use of any chemical composition enters—and put up in pressed tablets. It is claimed that the tablets, or cakes, ready for export contain an average of 80 per cent tannic acid and 16 per cent tannic glucose.

Colombia ranks second to Venezuela as a source of divi-divi. The estimated total annual output is 7,500 tons, the bulk of which is produced in the Goajira Peninsula and exported through the port of Rio Hacha to Curacao for transshipment.

The Dominican Republic's exports of divi-divi formerly exceeded 2,000,000 lb. annually, almost all of which was produced on the arid lands of the Province of Monte Cristi. The output, however, has been seriously affected in recent years by the presence of a species of orchid, which lives as a parasite on the divi-divi tree, frequently killing it and in every case reducing the yield of pods. The present annual production of the Dominican Republic and Haiti is estimated at 1,500 tons. Of the United States imports of divi-divi during the first 4 months of 1923 the Dominican Republic provided none in January, 54,810 lb. in February, 56,000 lb. in March, and 518,362 lb. in April.

The Dutch West Indies have an annual output of about 2,000 tons; all shipments in excess of this amount originate in Venezuela and Colombia. To our imports of divi-divi for January-April of this year, Curacao's contribution was 272,914 lb. in January, 162,300 lb. in February, 441,054 lb. in March, and 106,848 lb. in April, or 26 per cent of the total imports during this period.

As a general rule divi-divi pods are leached by the tanner. If passed through a disintegrator the pods are readily broken and the rich tannin powder is sifted out, which is mostly soluble in water. A liquid extract containing 25 per cent tannin is an article of commerce.

Uses of Divi-Divi

Divi-divi is rarely used alone because the leather thus produced is strongly affected by atmospheric conditions, being soft and spongy in damp weather and lacking pliability in periods of drought. To counteract these tendencies divi-divi is usually mixed with other tanning materials. If used in strong liquors it yields a heavy and firm leather. Ordinarily it is employed as a substitute for gambier in the dressing of leather, and in the rapid drum tannage of light leathers, through means of which an excellent color may be obtained. Occasionally its use in connection with leather is merely as a dye.

Freight has always constituted the dominating factor in the delivered price of divi-divi, for, owing to its bulkiness, its stowage, packed in sacks, requires 110 cu. ft. to the ton, which in times of tonnage scarcity has rendered transportation extremely difficult. Prior to the war ocean freight on divi-divi (which was usually handled by small sailing vessels) was $8 per ton; in 1919, however, it was $24 per ton from Colombia to New York. Present ocean freights from Venezuela to New York are $7.50 to $8 a metric ton.

Previous to 1914 Germany practically controlled the tanning-material market of South America and Hamburg fixed the prices. The price assigned to divi-divi was from 1½ to 2 cents a pound according to grade and origin. In 1883 the price of divi-divi at Venezuelan ports of shipment was $23.16 per metric ton of 2,204.6 lb.; in 1919 it ranged from $13.51 to $19.30 at Cumana and from $21.23 to $27.02 at Maracaibo. During the war prices attained a peak of $75 per ton, but in the early part of 1918 divi-divi was marketed in New York at $50 to $55 per ton. The general trend, however, in 1922 and the January-June period of 1923 has been toward the pre-war level, prices having fluctuated between $38 and $39 per ton during that period.

German Chemical Plants May Be Opened in Orient

While German chemical manufacturers are understood not to have abandoned the consideration of erecting factories in this country, it is known that they are rather dubious of the success of such a plan. The prospects of applying this policy to the Orient seem to impress the Germans as being more favorable. In the Orient they would have the advantages of cheap labor, a lower rate of taxation and would still have all of the advantages which go with their patents and secret processes. There, too, the German manufacturer would be less likely to lose his technicians and skilled employees to a competitor—one of the drawbacks to location in a country where a competitor would be likely to offer increased salaries to key men. By locating in the Orient a factory would be in the heart of a large consuming district, particularly were the product dyestuffs. The great objection to such a plan would be the difficulties of securing raw materials.

Sweden Regains Match Trade

The inability of Sweden to secure phosphorus and paraffin during the war permitted Japanese manufacturers of so-called safety matches to make great inroads in the export markets that had been supplied for many years by Swedish manufacturers. The difficulty of regaining markets once they are lost is well set forth in this instance, as it is only this year that Sweden has been able to bring its export of matches up to the volume of 1913. It happens, however, that the American market for these matches has increased greatly. Shipments from Sweden to the United States in 1922 were nearly three times as great as in 1913.

Find Georgia Clays Suitable to Replace English Material

The conclusions that have been reached by G. A. Bole and R. T. Stull in their studies of the use of sedimentary kaolins of Georgia in white wares, are as follows:

As indicated by tests made in two commercial plants, washed Georgia clays can be used to advantage to displace all of the English china clay in a vitrified dry press body of small size such as floor tile.

The washed clay can be used to displace a portion of the china clay in a porous dry press body such as wall tile up to about 20 per cent of the batch. However, the extent to which the displacement may safely be carried depends largely upon the shape and size of the ware.

The amount of the sedimentary clays that can be used in plastic bodies is much less than in a press body and should probably not exceed 10 to 15 per cent of the batch. The amount will vary with the ware being manufactured.

The proper blending of the clays together with judicious body mixes will render the Georgia clays much more available for white ware purposes. An increase in flint in bodies containing Georgia clays is essential to obviate crazing of the glaze, to reduce shrinkage and incidentally to improve whiteness.

The color of ware made from a properly washed clay is about equal to the usual grade of china clay, while it is only slightly inferior to the highest grade of English clay and domestic primary kaolins.

Investigations May Develop Export Trade in Chemicals

In the course of its work the Chemical Division of the Department of Commerce does not intend to lose sight of certain negative data that will be of service to the chemical industries.

There is a temptation to expend all the effort on getting information concerning conditions in those countries to which exports move in large volume. It is the plan to make studies of the situation in those countries to which we have no exports. While in many cases it is realized that there are good and sufficient reasons for this lack of movement, it is believed that by this process information can be obtained to indicate markets we can secure.

In compiling its recent list of countries to which American caustic soda is exported, a group of small ports was noticed to which we are making no shipments. Outside of a comparatively limited area in either direction, regular business was being done. A few minutes investigation disclosed the fact that a centrally located caustic soda plant in that area took care of all of the business in that immediate region. Whether or not such a study should disclose markets that have been overlooked, it is believed the information will be of value to the American industry, since it will indicate the exact reasons why business cannot be hoped for with certain countries or at certain ports.

A list now is being compiled showing the countries to which we export paints and varnishes and those to which there is no movement of those commodities. In connection with that list it is hoped to furnish some information as to the trade possibilities of those countries to which we are not exporting. A similar study of naval stores exports is in contemplation. As time and funds permit, it will be extended to other commodities.

News Notes

Electrochemists attending their Dayton convention, which is to be held Sept. 27 to 29, are to have an opportunity to take several interesting trips. Among those scheduled are trips through the National Cash Register Co., Delco, Delco Light, the General Motors Research Laboratories, Wilbur Wright field and the American Rolling Mills.

The gasoline reserve of the United States at the present is very high. On June 1 it stood at 1,228,000,000 gal., very little below the high record of May 1. The production of kerosene and lubricants is also keeping apace with consumption, with the result that little change in reserve supplies has taken place.

The wearing quality of leather has been the subject of a recent study by the Department of Agriculture. The effect of tannage, load, rolling, grease and of composition has been thoroughly investigated. Extensive data on the subject will soon be available in the form of Department Bulletin 1168.

To haul enough iron ore in one train to fill the holds of a lake steamer was the dream of James H. Hill. Recently this feat was accomplished between Superior, Wis., and the mine country of northern Minnesota. The cargo of the average boat is 9,000 tons. The amount of ore hauled on this train was slightly in excess of this amount.

The Provincial Paper Mills, Ltd., has opened a new plant in Port Arthur, which is one of the most modern paper making plants in Canada. The plant will produce from 30 to 40 tons of book paper and 35 tons of bleached sulphite per day, and it is expected to double the capacity with the installation of another paper machine.

The copper production of Alaska in 1922 was 77,967,819 lb., valued at $10,525,655, compared with 57,011,597 lb., valued at $7,354,496, in 1921, according to the Department of the Interior. The production in 1922 came from one mine in the Ketchikan district, three in the Chitina district and one in the Prince William Sound district. These figures are taken from the annual report of the Geological Survey.

British Engineer Develops New Gas Process

A new method of making coal gas has been invented by C. B. Tully, an engineer of Newark-on-Trent, Nottinghamshire, according to report received by the Department of Commerce from Vice-Consul Herbert C. Biar at Nottingham. After 3 years experimenting he has succeeded in reducing the amount of carbon monoxide in household gas from the usual 12 per cent. The experimental work is said to have definitely passed the research stage.

Apart from the importance of this invention from the standpoint of health and safety, it is also claimed by the inventor to have other aspects of interest, the report states, such as the possibility of making a gas containing from 87 to 90 per cent of hydrogen for synthetic ammonia and the obtaining of a more satisfactory gas for balloons and dirigibles.

The importance of the invention is said to be definitely proved by its adoption by new plants in various parts of the United Kingdom, and the London representative of a Japanese firm is reported to have arranged for an installation at Kobe, Japan.

June Imports of Coal-Tar Dyes at New York

The imports of coal-tar dyes through the port of New York for June totaled 247,174 lb., with an invoice value of $257,803. The following table shows the monthly imports through the port of New York for the year 1923:

Month	Lb.	Value.
January *	197,309	$185,344
February	191,709	199,640
March	312,809	301,436
April	242,022	256,751
May	261,869	292,340

*Not complete.

The five dyes leading in quantity imported were patent blue, indanthrene brown R, tyrogene blue, erio blue AB, and ciba violet B. Of the total quantity imported in June, 1923, 50 per cent came from Germany, 35 per cent from Switzerland, 10 per cent from Italy, 3 per cent from England and 2 per cent from Canada.

The imports of synthetic aromatic chemicals for June totaled 6,397 lb., with a total invoice value of $16,850. The imports of medicinals, photographic developers and other coal-tar chemicals for June totaled 216,538 lb., with an invoice value of $30,292.

Alcohol Handlers Must File Applications by Sept. 1

Prohibition Commissioner Haynes announced last week that all applications for the renewal for the year 1924 of permits for handling alcohol which expire Dec. 31, 1923, must be filed during July and August, which is 2 months earlier than heretofore. Applications not filed by Sept. 1 may be filed only by special consent up to Nov. 30.

London Interests Control Prices for Chilean Nitrate

Although the United States is the largest user of nitrate in the world, the evolution of the nitrate trade is operating to give Great Britain a strong advantage over this country, it is asserted by Charles J. Brand, marketing specialist for the Department of Agriculture, who studied the subject while visiting the principal European countries recently. Mr. Brand found that control of prices for Chilean nitrates practically rests with a London committee made up of representatives of the British nitrate houses. In consequence of the existence of a producers' association controlling about 97 per cent of the output and the methods of operation pursued thereunder, he says, competition which might force efficiency and economy in the production of the fertilizer is virtually eliminated, and the United States, which buys half the nitrate exported from Chile, is left without any say as to the price.

There is a reasonable parity between the prices of Chilean nitrate in Europe and the prices in the United States, Mr. Brand reports. His chief criticism of the present method of price fixing is that it affords no incentive to efficient production, and thus keeps prices higher than they need be. The producers are organized in an association which allots quantities sold to each plant in accordance with its capacity. Plants that cannot produce nitrate at the going prices sell their supply to the more efficient concerns, which for the sake of controlling as much tonnage as possible are willing to pay the less efficient producers a bonus to get their output. This practice, says Mr. Brand, inevitably penalizers nitrate users everywhere.

The nitrate producers' association was formed in 1919 with headquarters in Valparaiso. Its avowed object, according to Mr. Brand, is to increase consumption and fix prices. In theory the price fixing is done by a committee in Chile, but in reality by a London sub-committee whose recommendations are almost invariably adopted. How the sub-committee is chosen is not exactly clear, Mr. Brand says. Sir Arthur Goldfinch, who was director general of raw materials of the British War Office during the war, is the present chairman, and the Chilean consul-general and chargé d'affaires in London are ex-officio members.

The producers' association is a voluntary organization which was formed, says Mr. Brand, in 1919. Unless continued, it will expire on Jan. 10 next. All of the eighty-five producing companies in Chile are members, except American concerns representing 2½ per cent of the total capacity and perhaps one other small producer. It is the belief of the British trade that the life of the association will be extended. Mr. Brand thinks the association has performed some useful services, but regards the general effect of its price-fixing arrangement as injurious to nitrate consumers.

Price-fixing at the point of production by an association in which British interests are strongly represented does not, in Mr. Brand's opinion, indicate the existence of a British nitrate trust. Although the British houses work together harmoniously, they appear, he says, to be competing sharply in most phases of their business. He said they co-operate openly as to many things, while maintaining keen competition in selling. In 1920, to avert threatened disaster from price recessions, British nitrate firms organized a pool to distribute surplus stocks. The pool was liquidated June 30, 1922, since which date the trade has been conducted in the usual way.

Ammonium Chloride Wins Favor Over Sulphate in Germany

New Process Developed, Similar to Solvay, for Production of This Salt, Which Is to Be Used as Fertilizer

NEW METHODS of extracting chloride of ammonia are being adopted in Germany, according to a report from the office of the American consul-general at Frankfort-on-Main. This report states:

"Before the war the production of ammonia sulphate in Germany was easily undertaken in connection with the distillation of coal. The process was simple so long as sulphuric acid was cheap and available in sufficient quantities. The impossibility of importing sufficient pyrites during the war forced the owners of coke ovens to seek other processes of deriving ammonia, the conditions being that a cheap source of raw material to substitute sulphuric acid be found, and a fertilizer salt produced that would not be inferior to the sulphate.

"Such a salt is chloride of ammonia, and extensive experimentation concerning its production has been carried out. The attempt was made to use the chlorine in final lyes of the potash industry, which contain 30 per cent of chloride of magnesium. This conversion, however, is not complete, a double salt of slight nitrogen content resulting.

"It was decided to convert the ammonia and carbonic acid with common salt, according to the Solvay process. Besides soda, a final liquor is derived by this process, containing the entire ammonia introduced in the form of ammonia chloride and considerable quantities of salt. These lyes are evaporated for the production of solid chloride of ammonia, and at the same time the demand for ammonia for the production of soda is met by the use of condensed gas water, instead of by the Solvay process of regenerating the ammonia from the final lyes by boiling with lime milk. The final lye contains 16 to 18 per cent of chloride of ammonia and 8 to 10 per cent of salt. After evaporation, it contains equal quantities of chloride of ammonia and salt. The greater part of the salt is thus separated in solid form. The evaporization requires the use of 2.4 tons of coal for each ton of ammonia, with 2.2 tons of salt obtained as a byproduct. It is estimated that chloride of ammonia obtained by this process can compete in the chemical market with sulphate of ammonia, even if the mark prices of foreign pyrites and sulphuric acid should fall.

"The question of material for the evaporating containers, which is of very general importance, was undecided. Since chloride of ammonia even at a comparatively low temperature disassociates into ammonia and hydrochloric acid and affects the surface, a special non-corrosive material was necessary. A satisfactory substance is said to have been found, but the composition is not revealed.

"Further experimentation showed that it is also feasible to separate the salt and to take only a part of the chloride of ammonia from the lye. In establishing a large plant, it is planned to utilize the steam for the generation of electric power, making the process of even greater economic value."

Norwegian Makes Wood

A mixture of 50 per cent sawdust mixed with 50 per cent of chalk and other chemicals has recently been successfully used by a Norwegian in making "artificial wood" for which all of the qualities of the genuine article are claimed. A newspaper report from that country states that the mixture is subjected to a very high pressure, which imparts a specific gravity approximately the same as that of hardwood.

It can be planed, sawed, bored, nailed, painted, stained or polished, and subjected to every process of carpentry or manufacture for which real wood is used. It is said that it will not deteriorate in water, and on account of the chemicals it contains it is impervious to rot and burns only at a temperature very much higher than that at which real timber ignites.

Discover Feldspar Deposit

A deposit of high-potash feldspar has been located 5 miles from Perth in Lanark county, eastern Ontario, which gives much promise. Operations to date have been confined to a phenomenal dike of feldspar 1,000 ft. long and 300 ft. wide. This mass rises to a height of from 40 to 60 ft. above the main highway that intersects the property. This dike contains many thousands of tons of marketable feldspar—sufficient to supply the ceramic industry of America for a long time. Samples tested by a large manufacturer of insulators have been reported upon as being satisfactory.

Facts and Figures That Influence Trade in Chemical Products

Market Conditions

Current Prices
Imports and Exports
The Trend of Business

Buying Orders for Chemicals Show Improvement During Week

Large Fertilizer Interests Place Contracts for Potash—Scattered Small Lot Buying of Chemicals Reaches Larger Volume—Numerous Price Changes Reported

DESPITE the holiday traders report some improvement in demand for chemicals. To begin with contracts for potash requirements of the fertilizer trade were placed during the period. Details on these contracts were not made public but as the so-called "Big Six" were parties to the contracts it is evident that there is an element of truth to reports that the amounts involved were large. It is unofficially stated that prices were in accord with the current schedule and that the usual discounts were allowed.

Many consumers of chemicals who are buying according to needs also were reported to have been in the market and in different quarters it was stated that business generally considered was an improvement over that of 2 weeks ago. Improved weather conditions have created a more seasonable demand for some materials, although the customary summer dullness is felt in the case of many items.

Interest is more keen in calcium arsenate and buyers have been willing to operate when their views were met but irregularity in prices has a deterring effect and sales of moderate amounts at low prices have upset the market and given the impression that values were lower than actually is the case. Demand for arsenic has become quiet and prices for forward positions are steadily declining.

Metal salts have moved in sympathy with the metal markets. In the previous week tin oxide was lowered in price and last week tin crystals and bichloride of tin were placed on lower price schedules. Weakness in lead brought out a decline in the lead pigments, but acetate of lead was left unchanged.

Imported chemicals show no definite price trend. In many cases spot holdings are large and efforts to reduce stocks have resulted in prices below replacement costs. In other cases cables show that shipments are under prevailing spot values. Export demand likewise is irregular with some of the more important chemicals receiving but little attention while others are finding a ready outlet in markets abroad.

Acids

Boric Acid—Producers report a good call for this acid both for home and export. Stocks are moving regularly from works and prices are said to be low when compared with production costs. Sellers are in active competition and as long as this condition exists, advances are regarded as improbable. Quotations are 10½@11c. per lb. in bbl. and 11@11½c. per lb. in kegs.

Citric Acid—A strong call is noted for domestic acid and most producers are using their output to take care of existing orders. Prices for domestic are given at 49@50c. per lb. but offerings are not free. Imported acid has moved more freely but considerable amounts are held by importers and sales have been made at concessions from the asking prices of 51½@52c. per lb.

Alcohol Advances 3c. per Gal.—Tin Crystals and Bichloride of Tin Reduced Sharply—Lower Shipment Prices for Arsenic—Imported Tartaric Acid Easy—Nitrate of Soda Firmer—Bichromates Dull and Easy—Lower Cables on Oxalic Acid—Prussiates Inactive.

Formic Acid—Offerings of domestic are not important and imported grades are receiving the attention of buyers. Interest has been gaining and prices are working into a very steady position. Quotations heard during the week varied from 12c. to 14c. per lb.

Lactic Acid—Steady buying has been a feature and round lots have been taken from the market. Imported grades are scarce and are little better than nominal in price. Domestic makers are offering 22 per cent dark at 4½@5c. per lb. and 22 per cent light at 5½@6c. per lb.; 44 per cent dark at 9½@10c. per lb. and 44 per cent light at 11½@12c. per lb.; U. S. P. 65@70c. per lb.

Muriatic Acid—Contract deliveries are taking up this acid in good volume but new business continues to be light and the market offers nothing new in the way of activity or of price changes. Asking prices are 90c.@$1 per 100 lb. for 18 deg.; $1@$1.10 for 20 deg.; and $1.75@$2 for 22 deg.

Oxalic Acid—The spot market for imported acid is holding steady at 13c. per lb. but cables were received last week offering shipments at 12c. per lb. and this has had a tendency to restrict buying. Domestic oxalic is quoted at 12¼c. per lb. at works.

Tartaric Acid—The market is featured by a steady quotation of 37½c. per lb. for domestic and an irregular price for imported. Spot sales of imported have been made at 35c. per lb. and asking prices range up to 36c. per lb. with the difference depending on seller and quantity. Stocks are fairly large but foreign markets are steady and it is evident that local prices are due to desire of holders to move stocks.

Potash

Bichromate of Potash—Business was very quiet during the week. Sellers have been more eager to attract buyers and are offering round lots at 11c. per lb. works, with smaller lots quoted up to 11½c. per lb. Large consuming trades are quiet at present and this condition naturally is reflected in the market for bichromates.

Caustic Potash—Buying orders were in the market for imported caustic but bid prices were at 7c. per lb. and under and the lowest figure of sellers was 7¼c. per lb. with many holding out for 7½c. per lb. The market was weakened, however, by cable offerings at 6¾c. per lb. for shipments and trading in spot goods also was slowed up by the low prices quoted for forward deliveries. Domestic caustic is quoted at 9c. per lb. at works and sales are reported at that price.

Carbonate of Potash—Buying has been confined to moderate sized lots. Calcined 80-85 per cent is in limited supply but scant offerings appear to have had the effect of holding prices on a steady basis rather than to have given an upward trend to values. The quotation remains at 6¾c. per lb. Calcined 96-98 per cent was available at 7c. per lb. and 90-95 per cent could be brought at 6¾c. per lb. Hydrated 80-85 per cent was quiet with reports of price shading but 7½c. per lb. was quoted.

Chlorate of Potash—Further reports of sales of imported at 7c. per lb. were heard and this figure seems to be established as the actual trading basis. Domestic chlorate is quiet but prices are holding up at 8½c. per lb. at works.

Permanganate of Potash—Sales of small lots were put through during the week at 18c. per lb. For larger amounts there were sellers at 17c. per lb. and some reports credited sales under the 17c. level, although the market is not suffering much from selling pressure and current prices for spot goods are under replacement costs as fixed by cables received during the week.

Prussiate of Potash—Prices on yellow

prussiate of potash are a matter of seller. In some quarters 34c. per lb. and upward is the asking price. Other sellers are open to business at 31@32c. per lb. Trading is dull and as shipment prices are not changing materially, there is not much incentive for buyers to push matters.

Sodas

Acetate of Soda—Demand has been slow and holders of spot goods have shown a willingness to accept bids at 5½c. per lb. The open quotation f.o.b. works is held at 5½c. per lb. and upward according to quantity but it is probable that the quotation can be shaded.

Bichromate of Soda—Slower demand in recent weeks has resulted in accumulation of stocks in sellers' hands. With selling pressure keener, prices have weakened and the open market quotation has been reduced to 8½c. per lb. for carlots at works. For smaller lots the usual quantity range is effective. Chrome ore as quoted at $21 per ton for Indian; $23 per ton for Rhodesian and $25 per ton for New Caledonian, the prices being c.i.f. Atlantic ports.

Caustic Soda—The contract movement is holding up and domestic consumers appear to be using more than normal amounts. New business is reported to be fair and no heavy accumulations have been in evidence. Export business is quiet and reports are heard to the effect that standard brands can be bought at 3.25c. per lb. f.a.s. although the quotation is 3.30c. per lb. The price f.o.b. works holds at 3.16½c. per lb. for carlots in drums. Ground caustic is offered at 3.60c. per lb. in drums and 3.85c. per lb. in bbl.

Fluoride of Soda—Under moderate buying prices have been firmly maintained and sellers are reported to be carrying only small lots of imported. Foreign markets also have been firm and while 9c. per lb. is still heard for spot imported, the lowest price in some quarters is 9½c. per lb. Domestic fluoride is quoted at 10½@11c. per lb.

Nitrate of Soda—A firm feeling has prevailed in the spot market and some sellers who had been willing to do $2.40 per 100 lb. were holding out for $2.45 per 100 lb. Reports from primary markets have indicated firm conditions and importers no doubt have been influenced by them. It is also pointed out that sales for forward positions made a short time ago were at higher levels than have been heard in the past few weeks for spot material and this removes the possibility of low priced resale material. Refined nitrate is offered at 4½@4¾c. per lb. for granulated and 5½@5¾c. per lb. for powdered.

Nitrite of Soda—Domestic nitrite is meeting with a quiet call from consumers with the price for round lots holding at 7¼c. per lb. at works. Imported nitrite has not declined in the same degree as the domestic and evidently is not competing except where freight rates are very favorable. The general quotation on spot is 7⅞c. per lb.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	172.91
Last week	174.28
July, 1918	277.00
July, 1919	231.00
July, 1920	274.00
July, 1921	148.00
July, 1922	156.00

The easier situation in bleaching powder, caustic soda for export and crude cottonseed oil offset the advance in alcohol and the week's index number shows a decline of 137 points.

Prussiate of Soda—The market has held an unchanged position. Demand is very quiet. Domestic prussiate is offered at 15½c. per lb. and this price holds good for shipments over the current month. Imported can still be done at 14c. per lb. with up to 14½c. per lb. asked.

Miscellaneous Chemicals

Arsenic—With the active buying season drawing to a close, there has been no improvement in demand and scarcity of stocks as predicted earlier in the season has failed to materialize. There were offerings on spot last week at 11¾@12c. per lb. Prices still vary according to seller and some high priced arsenic is said to be still held by importers. Japanese arsenic for Sept.-March shipment was offered at 9½c. per lb. which is the lowest figure yet heard.

Bleaching Powder—Some good sized orders have come on the market and interest has been stimulated by the lower prices which recently were announced. Some sellers have been reluctant to meet the lower price but the reduction did little more than place the open market quotation down to the level at which business was being done for some weeks. The contract price remains at $1.75 per 100 lb., carlots at works.

Calcium Arsenate—Inquiry is better and deliveries against old orders are taking large amounts to consuming centers. Prices for spot and July deliveries are unsettled. It is freely admitted that sales have been made at low prices, as low as 12c. per lb., but only limited amounts were available at low prices and buyers who have bid at low levels have failed to find material. Some reports say that bids at 14½c. per lb. have gone unfilled and 15@16c. per lb. is quoted by some sellers. Under the circumstances no definite price can be given and private terms rule in transactions. The market is more complicated by reports that some calcium arsenate offered has not come up to specifications.

Copper Sulphate—Imported material does not show any stability. Spot goods sold last week at 4⅝c. per lb. and shipments were offered at 4½c. per lb. without attracting interest. Domestic sulphate is held at 5½c. to 5.60c. per lb. according to seller.

Formaldehyde—Odd lots were offered during the week at 14c. per lb. The market is quiet and in spite of attempts to hold prices on a steady level, concessions are granted from time to time as an inducement to buyers. General asking prices are 14½@14¾c. per lb.

Pyrites—Demand has been quiet, as many consumers are using other materials. Imported lump, 1 in. diameter and up is quoted at 11½c. per long ton unit; furnace size 2½ in. diameter 12c. per long ton unit; fines, through ½ in. mesh, 11½c. per long ton unit; cinder property of buyer, ex-ship, Atlantic ports.

Soda Ash—There is a steady movement against old orders and consumption is well up to normal. New business is seasonable and prices are steady. Light ash is quoted at 1.33c. in bulk and 1.45c. in single bags, carlots at works. Dense ash is quoted at 1.42c. in bulk and 1.51c. in single bags. In the spot market light ash is held at 1.75c. in single bags and 1.95c. in bbl.

Tin Crystals—Weakness in the tin market reduced the monthly average price of the metal and effective July 2 producers announced a decline of 4c. per lb. for tin crystals, making the selling price 30½c. per lb. Bichloride of tin also was marked down, with the new price at 11½c. per lb.

Alcohol

Producers announced a 3c. per gal. advance in the market for denatured alcohol. All formulas share in the uplift. The special grade, formula No. 1, was revised to 38c. per gal., in drums, and 44c. per gal., in barrels. The No. 5 formula, in drums, carload lots, settled at 37c. per gal., basis 188 proof. Ethyl spirits were advanced along with the denatured and on the U.S.P. quality, 190 proof, the market closed at $4.75 @$4.80 per gal., as to quantity. Cologne spirits was revised to $4.77@$4.82 per gal. The market for methanol was nominally unchanged, although a steady undertone was in evidence. Leading operators quote the 95 per cent grade on the basis of $1.18 per gal. On the 97 per cent grade $1.20 was asked.

South Africa Increases Carbide Production

Production of carbide is probably one of the youngest South African industries, according to a report on this subject received by the Department of Commerce from Consul G. K. Donald, at Johannesburg. The present sole manufacturer, Rand Carbide, Ltd., was organized in 1922. The capacity of its factory is 250 tons a month. In 1920, 4,000 tons of carbide was imported, and importations now have declined to almost nothing. The Union of South Africa requires 350 tons a month, of which the Rand Carbide, Ltd., supplied 313 tons last February. Preparations are being made to enlarge the factory, so that it is evident, the consul reports, that there is no longer a market in South Africa for carbide made abroad.

Coal-Tar Products

Salicylic Acid Unsettled—Nearby Phenol Lower—Crude Naphthalene Easier Abroad—Benzene Quiet

SUPPLIES of salicylic acid were more plentiful and with no improvement in the demand prices were unsettled, several producers intimating that on round lots bids at moderate concessions would probably be accepted. The easier situation in phenol brought out the freer offerings in salicylates. Traders take the stand that production of phenol will be sufficient before long to put the market on a more normal basis, and the recent weakness in the acid tends to confirm this view. There were sellers of nearby phenol down to 35c. per lb, while spot material sold as low as 38c. per lb. Advices from abroad reported an easier market for crude naphthalene. Offerings at 2¼c. per lb, c.i.f. New York, failed to attract buyers. The creosote oils were nominally unchanged. Glasgow reported offerings at 9½d. per gal., bulk basis. Cresylic acid was available in the British markets around 2s. ld. per gal. The spot market for cresylic acid was so unsettled that it was impossible to name a flat price. Benzene was inactive and with gasoline available at low prices operators look for no improvement in the marketing situation so far as the near future is concerned. Solvent naphthas met with a steady call, but little could be picked up because of the sold-up condition of producers. Demand for intermediates was quiet.

Aniline Oil—Producers continued to quote on the carload basis of 16c. per lb. Outside interests offered small parcels at this figure.

Benzidine Base—Scattered lots sold at 85c. per lb., spot. On round-lot business for shipment 80c. was the nominal asking price.

Benzyl Chloride—Refined held at 45c. per lb., in drums, but few orders were placed. On the technical variety producers asked from 30@35c. per lb, as to quantity and delivery.

Benzene—The market for benzene was nominally unchanged so far as the larger producers were concerned, but with business slow and competition keen, smaller operators resorted to price cutting. The fact that gasoline is selling at much lower prices than a year ago accounts for the slump in demand for benzene for motor fuel purposes. The 90 per cent grade was offered by leading factors at 25c. per gal., in tank cars, f.o.b. works, while on the water-white (pure) 27c. per gal., represented the market.

Dimethylaniline—While the call for this product was inactive, prices were repeated on the basis of 41@42c. per lb., immediate shipment from works.

Naphthalene—Chipped naphthalene was offered on the carload basis of 6c. per lb., f.o.b. Philadelphia. On flake, immediate delivery, the market held at 7¼@7¾c. per lb., New York. The market was quiet and the undertone at the close was barely steady. Crude was offered for shipment from the other side at 2¼c. per lb., c.i.f. New York.

Creosote—Neutral creosote oil was offered on spot at 24c. per gal., with the 10@15 per cent at 26c. per gal., and the 30 per cent grade at 34c. per gal.

Cresylic Acid—Owing to the duty situation offerings of cresylic acid increased and prices developed further weakness. There were offerings of the 95 per cent grade as low as 90c. per gal., immediate shipment. Some traders continued to hold out for $1 per gal. on the 95 per cent grade, and $1.10@$1.15 per gal. on the 97 per cent. Advices from Glasgow report the market as barely steady at 2s. 1d. per gal.

Phenol—The spot market for resale material settled around 38@40c. per lb., U.S.P. quality. On nearby deliveries there were sellers down to 35c. On contract to "regular" buyers producers were willing to do 28c. per lb. On distant deliveries prices were wholly nominal. Consumers refused to contract far ahead because of the unsettled state of the market.

Salicylic Acid—Prices asked by first hands ranged from 40@45c. per lb., on the U.S.P. grade. The market was easier in some quarters and on round-lot transactions it would have been possible to shade prices.

Xylene—The pure was offered by first hands for shipment at 65c. per gal., f.o.b. works. On spot goods the market was nominal around 85@90c. per gal.

Financial Notes

It is stated that plans for reorganizing the International Agricultural Corporation are being worked out. The plans do not contemplate any assessment on either common or preferred stock.

The Atlantic Refining Co. of Philadelphia has declared a quarterly dividend of $1.75 on preferred stock, payable Aug. 1 to stock of record July 16.

For the 3 months ended March 31, 1923, the Replogle Steel Co. shows consolidated loss of $109,865, after expenses, taxes and reserve for depreciation.

Operations of the Southern Cotton Oil Co., a subsidiary of the Virginia-Carolina Chemical Co., were largely responsible for the poor showing of the latter company in the fiscal year ended May 31.

Trade Notes

Bankruptcy schedule of the Jacksonville Chemical Co., 246 Water St., New York, shows liabilities of $43,349 and assets of $15,850. Among the creditors are the Durex Chemical Corporation, $3,015; E. I. du Pont de Nemours & Co., $2,025; Briggs Chemical Co., $2,127; Waverly Oil Works, $2,445.

The government iron works at Wawata, Japan, has begun the manufacture of tin plate.

The Paris Chamber of Commerce has reported favorably regarding the establishment of a market for trading in futures of plantation rubber.

Exports of quebracho extract from the Argentine from Jan 1. to June 21 were 75,000 tons. About 40 per cent of this extract was shipped to the United States.

The John A. Steen Varnish Co. of Chicago, has bought from the La Salle Varnish Co. a three-story factory building at 37th and Shields Sts.

Robinson & Stevens, 96 Wall St., New York, who have represented the Rosin & Turpentine Export Co. for several years, are now representing Isaac Winkler & Bro. of Cincinnati.

C. F. Beatty has succeeded A. C. Stedman as advertising manager of the New Jersey Zinc Co. Mr. Stedman will take up work in connection with the sales end of the business.

By an almost unanimous vote, the Ontario Retail Grocers' Section of the Retail Merchants' Association of Canada, in convention in Brockville, Ontario, passed a resolution requesting the dominion board of the parent association to take the necessary action looking to the repeal of the recent legislation which banned the importation and manufacture of oleomargarine in Canada.

The Union of South Africa has passed an act prohibiting the sale, manufacture or importation of adulterated leather. The act defines the term adulterated leather.

A good yield of camomile is reported from Austria. As much as 50,000 lb. of the flowers will be available, most of which will be exported to the principal drug-marketing centers.

While Germany is selling most of the paper and paper products and much of the cement going to Peru, the United States seems to have wrested from it the chemical market in that republic. The United States now is furnishing the bulk of the chemicals, drugs and explosives used in Peru.

Haines Shellac Works, Inc., of New York, has filed schedules in bankruptcy, showing liabilities of $15,064 and assets of $9 811.

Vegetable Oils and Fats

Cottonseed Unsettled on Acreage Report—Linseed Futures Easy—Olive Foots Higher—Crude Corn Declines

THE acreage report on cotton was better than traders thought possible, and, despite the rather unfavorable condition of the crop, indications point to a substantial increase in the production of lint. This will mean larger stocks of seed and a liberal quantity of cottonseed oil for the 1923 season. The first official crop report on flaxseed will be issued this week. The edible oils were inactive all week, but some improvement was reported in demand for the technical oils.

Cottonseed Oil—The Department of Agriculture estimates the area sowed to cotton at 38,287,000 acres, the largest in the history of the industry. This compares with 34,916,000 acres last year. The condition of the crop was placed at 69.9 per cent of normal in the report issued on July 2, and the yield of lint per acre was estimated at 142.6 lb. to the acre. Total production was estimated at 11,412,000 bales. Operators in cottonseed oil were inclined to take a bearish view of the future and transactions in the new crop positions were held down to a minimum. July tenders were increased to 5,200 barrels and this brought out more liquidation in the current month with the result that prices eased off. Old crop crude sold at 8¾c. per lb., in tanks, f.o.b. mills, which compares with 9¼c. a week ago. New crop crude was wholly nominal around 7c. per lb., f.o.b. mills. Bleachable oil was offered at 9½c. per lb., buyers' tanks, f.o.b. Texas common points. Prime summer yellow on spot closed at 10¾c. per lb., in bbl. Lard compound was inactive, but steady at 12¾@13c. per lb., carload basis, f.o.b. New York. Pure lard steadied in the west. Stocks of lard in Chicago on July 1 were estimated at 62,601,967 lb., as against 29,316,144 lb. on June 1. The heavy gain in lard holdings was considered normal for this time of the year. Oleo stearine was firmer, closing at 8¾c. per lb. on export inquiry.

Linseed Oil—The feature was the easier position of futures. It was reported that a crusher sold some 200,000 gal. of October-November-December oil on the tank car basis of 82c. per gal., the equivalent of 87c. per gal. in cooperage. Later offerings came out at this figure for November-March shipment, but consumers did not care to trade so far ahead. Spot oil closed at $1.08 per gal., in cooperage, with late July at $1.05 per gal. and August at $1.01 per gal. Several cars of August oil sold on the $1.01 basis. There was a little more interest in fall delivery oil, but buyers' ideas, in nearly all instances, were several cents below the market. The new crop is doing fairly well and when the official figures finally do come out traders feel confident that the predictions of a gain over last season's acreage will be substantiated. Reports from Canada do not speak of any important change in the flaxseed acreage. Conditions in the Argentine as well as India underwent no important change. Argentine exports of flaxseed since Jan. 1 amounted to approximately 34,700,000 bushels. The stocks of seed at Minneapolis on June 30 were estimated at 19,360 bu., which compares with 23,342 bu. the week previous. The stocks at Duluth at the close of last week amounted to 34,982 bu., as against 47,203 bu. a week ago. The stocks at the Canadian terminals amounted to 218,357 bu., as against 228,796 bu. the week previous. Linseed cake was quiet, with the market easier in sympathy with advices from abroad. Cake for export settled around $35@$36 per ton, f.a.s. New York.

China Wood Oil—July-August oil was offered at 23c. per lb., cooperage basis. On the Pacific Coast July oil was offered at 21c. per lb., tank car basis. Demand was quiet and prices were barely steady.

Coconut Oil—No important trading developed and prices in some quarters were unsettled. On the coast Ceylon type oil held at 7¾c. per lb., sellers' tanks, nearby positions. There were offerings at 8c. per lb., f.o.b. Philadelphia.

Corn Oil—There were sales of crude corn oil at prices ranging from 8¼@8½c. per lb., sellers' tanks, f.o.b. point of production, a decline of ⅛c. for the week.

Olive Foots—There was a fair call for prime green foots and sales went through at 8½c. per lb., an advance of ¾c. from the low of a week ago.

Palm Oils—Offerings of spot Lagos oil were reported at 7c. per lb., which, according to traders, was below the prevailing cost of import. Niger oil on spot could have been picked up for 6¾c.

Sesame Oil—Refined oil was offered at 11½c. per lb., in cooperage, spot. On futures 10¾c. could have been done.

Soya Bean Oil—Additional transactions in distressed material brought out further weakness in the market. There were sales in New York at less than 9c. per lb., sellers' tanks, duty paid.

Fish Oils—Fishing for menhaden was good and with the fish running larger the yield of oil was up to normal for this time of the season. New business was disappointing and it was reported that bids at 45c. f.o.b. factory would have met with consideration. Newfoundland tanked cod oil sold on the basis of 65c. per gal., f.o.b. New York.

Tallow and Greases—Extra special tallow held at 6¾c. per lb., with the undertone steady. There were buyers at 6⅝c. per lb. Some export inquiry developed for greases and good quality yellow brought from 5¼@6c. per lb. No. 1 oleo oil was unchanged at 12c. per lb., in bbl., New York. Chicago reported offerings of No. 1 oleo stock at 9½c. per lb.

Miscellaneous Materials

Casein — Offerings were large and spot prices were irregular, the lower grades being available at 15½@16c. per lb.

China Clay—Crude powdered was offered at $13@$20 per ton, f.o.b. Virginia points. Imported lump held at $15@$20 per ton, f.o.b. American ports.

Barytes—It is reported that lithopone manufacturers are showing more interest in the producing end and there is a possibility that they will buy up barytes properties. The market for barytes was steady. On the crude nominal contract prices ranged from $8@$10 per ton, f.o.b. St. Louis. Floated held at $28 per ton, f.o.b. St. Louis.

Glycerine—Chemically pure was offered at prices ranging from 16@16½c. per lb., in drums, carload lots. The market was unsettled, especially in the middle-west. Sales of dynamite glycerine went through early last week at 14½c. per lb., carload basis, in drums, the price showing no change from the nominal quotation of the week previous. Crude was slightly firmer, holders asking 10c. per lb. on the soap-lye, basis 80 per cent, loose, carload lots. Buyers' ideas on the soap-lye were nearer 9½c. per lb. Saponification, basis 88 per cent, loose, closed nominally at 10½c. per lb., carload lots, f.o.b. point of production.

Naval Stores—Further weakness was apparent in the market for turpentine. Demand was inactive, especially in an export way, and with supplies coming forward on a larger scale than last season, offerings at 93c. per gal. failed to interest prospective buyers. The rosins closed about unchanged, the lower grades holding at $5.80 per barrel.

Shellac — Lower primary markets brought out renewed pressure here and T.N. sold down to 51c. per lb., which compares with 55c. the week previous. Bleached, bonedry, settled at 65c. per lb. Demand was quiet.

White Lead—Corroders announced a ½c. per lb. reduction in all of the lead pigments. The decline was looked for in most quarters inasmuch as the metal had declined rather sharply in the past month or so. Pig lead was reduced further, the leading interests quoting 6.35c. per lb., f.o.b. New York. Standard dry white lead closed at 9½c. per lb., in casks, round-lot basis. Litharge was lowered to the basis of 10¾c. per lb., in casks, carload lots.

Lithopone—The market ruled steady at 7@7½c. per lb., the inside figure obtaining for the material put up in bags, carload lots. Several parcels of imported lithopone arrived here last week.

Zinc Oxide — The market was unsettled in some quarters, but leading interests continued to maintain prices on the basis of 8c. per lb., American process, lead free. French process, red seal, held at 9¾c. per lb. Demand was slow, due in part to decreased activity in the rubber industry.

Imports at the Port of New York

June 29 to July 5

ACIDS—Cresylic—10 dr. Rotterdam, Lunham & Moore; 56 dr., Liverpool, Order. Oxalic—16 csk., Hamburg, Schenker & Co.; 67 csk., Bergen, Roessler & Hasslacher Chem. Co. Tartaric—100 keg, Southampton, A. H. Pickering.

AMMONIUM CARBONATE — 10 csk. Liverpool, Order.

ANTHRACENE — 101 dr. Rotterdam, Proteol Corp.

ANTIMONY OXIDE—200 pkg., Changsha, Union Trust National Bank.

ANTIMONY REGULUS—250 cs. Hankow Order.

ANTIMONY SULPHUR—15 cs., Southampton, Order.

ARSENIC—400 cs., Kobe, S. W. Bridges & Co.; 50 cs., Kobe, McKenzie & Foster; 100 cs. Kobe, National Shawmut Bank; 58 cs., Kobe, G. F. Taylor & Co.; 150 cs., Kobe, Busk & Daniels; 100 cs., Kobe, Order; 192 bbl., Tampico, American Metal Co.

BAUXITE—56 tons, Paramaribo, A. M. Kohler.

BARIUM CHLORIDE—104 csk., Antwerp, Order.

BRONZE POWDER—30 cs., Bremen, B. F. Drakenfeld & Co.; 8 cs., Bremen, Order.

BONE-MEAL—5,080 bg., Rotterdam, H. J. Baker & Bros.

BORATE—6,606 bg., Mejillones, Pacific Coast Borax Co.

CASEIN—834 bg., Buenos Aires, Order; 99 bg., Melbourne, Order; 100 bg., London, A. Hurst & Co.

CHALK—1 lot in bulk, Dunkirk, Taintor Trading Co.; 500,000 kilos, Dunkirk, J. Higman Co.; 5,290 bg., Antwerp, Order; 500 bg., Antwerp, L. A. Salomon & Bros.; 500 bg., Antwerp, Cooper & Cooper, Inc.; 300 bg., Antwerp, Reichard-Coulston, Inc.

COAL-TAR PREPARATIONS — 10 cs., Hamburg, Franklin Import & Export Co.

COPPERAS—82 bbl., Liverpool, Order.

COPPER OXIDE—50 dr., Hamburg, Am. Metal Co.

COPPER SULPHATE—90 csk., London, Ore & Chem. Corp.

COLORS—4 csk. ultramarine, Bremen, A. Hurst & Co.; 7 cs. dry, London, R. F. Downing & Co.; 3 csk. aniline, Rotterdam, National City Bank; 6 bbl. aniline, Danzig, Ackerman Color Co.; 8 csk. dry, Bremen, M. G. Lange & Co.; 5 csk. ultramarine, Antwerp, Simon & Elting; 5 csk. coal-tar, Hamburg, Irving Bank-Col. Trust Co.; 15 pkg., Hamburg, H. A. Metz & Co.; 11 csk., Hamburg, H. R. Jahn; 10 csk. aniline, Hamburg, Kuttroff, Pickhardt & Co.; 25 pkg. dry, Hamburg, E. C. Foster.

CHEMICALS — 125 carboys, Bremen, Roessler & Hasslacher Chem. Co.; 50 bbl., Bremen, Order; 95 csk., Antwerp, A. Klipstein & Co.; 193 pkg., Antwerp, Order; 3 cs., Hamburg, Companie Duval.; 32 pkg., Hamburg, Order; 22 csk., Hamburg, Chaplain & Bibbo.

COPRA — 2,904 bg., Belize, Franklin Baker Co.; 242 bg., Demerara, F. P. Rogers; 222 bg., Port Morant, Franklin Baker Co.; 101 bg., St. Anns Bay, Order.

DIVI-DIVI—816 bg., Maracaibo, Meyer & Co.

DYESTUFFS—6 bbl., Genoa, American Exchange National Bank; 3 bbl., Genoa, Ackermann Color Co.

EPSOM SALT — 894 bg., Hamburg, Hansa Co.

FERROCHROME — Quantity in bulk, Gothenburg, Hardy & Ruperti; 26 csk., Gothenburg, D. Heydemann & Co.

FERROMANGANESE—50 cs., Havre, De Courcy Browne.

FERROSILICON—625 csk., Gothenburg, Hardy & Ruperti.

GLAUBER SALT—398 csk., Hamburg, Order.

GREASE—404 bbl., Southampton, J. C. Francasconi & Co.

GUMS—210 bg. copal, Singapore, Chemical National Bank; 70 bg. do., Singapore, Guaranty Trust Co.; 200 pkg. damar and 120 bg. copal, Singapore, Baring Bros. & Co.; 50 cs. damar, Singapore, Kidder, Peabody & Co.; 140 cs. copal and 350 bg. damar, Singapore, L. C. Gillespie & Sons; 90 cs. damar, Singapore, Order; 100 cs. damar, Singapore, Chemical National Bank; 472 bg. arabic, Port Sudan, Thurston & Braidich; 263 bg. do., Port Sudan, Brown Bros. & Co.; 825 bg. do., Port Sudan, Duche & Sons Co.; 225 bg. do., Port Sudan, Order; 305 cs. kauri, Auckland, Baring Bros. & Co.; 392 cs. do., Auckland, J. D. Lewis; 320 pkg do., Auckland, Chemical National Bank; 239 cs. do., Auckland, Guaranty Trust Co.; 327 cs. do., Auckland, Order; 40 bg. copal, Antwerp, Brown Bros. & Co.; 200 bg. do., Antwerp, Equitable Trust Co.; 40 cs. tragacanth, Southampton, Thurston & Braidich; 58 bg. damar, Southampton, Baring Bros. & Co.; 24 bg. copal, Southampton, S. Winterbourne & Co.

IRON OXIDE—7 cs., Liverpool, Hammill & Gillespie; 39 csk., Liverpool, J. L. Smith & Co.; 91 csk., Liverpool, Reichard-Coulston, Inc.; 25 csk., Liverpool, Order.

LOGWOOD—300 tons, St. Marc. W. A. Leaman; 195 bbl. extract, Cape Haitien, Logwood Mfg. Co.

LITHOPONE—900 csk., Antwerp, Benjamin Moore & Co.; 204 csk., Antwerp, E. M. & F. Waldo.

MAGNESIUM—175 cs. citrate, Genoa, Order; 55 bbl. chloride, Hamburg, Speiden-Whitfield Co.

MAGNESITE—330 bg. calcined, Rotterdam, H. J. Baker & Bro.; 87 bbl., Rotterdam, A. Kramer & Co.; 326 bbl., Rotterdam, Speiden, Whitfield Co.; 937 bg., Rotterdam, Ianis, Speiden & Co.

MENTHOL — 50 cs., Kobe, Equitable Trust Co.; 25 cs., Kobe, S. W. Bridges & Co.; 30 cs., Kobe, Stallman & Co.

NICKEL SULPHATE—40 csk., Hamburg, Pfaltz & Bauer.

OILS—Cod—155 csk., St. Johns, R. Badcock & Co. China Wood—50 dr., Hong Kong, I. R. Boody & Co. Linseed—189 dr., Rotterdam, W. Van Doorn. Olive (sulphur oil)—200 bbl., Catania, Banca Comm. Italo. Palm Oil — 1,250 csk., Calabar, African & Eastern Trading Co.; 300 csk., Lagos, African & Eastern Trading Co.; 350 csk., Port Harcourt, African & Eastern Trading Co.; 30 csk., Hamburg, African & Eastern Trading Co. Sesame—590 bbl., Rotterdam, American Cotton Oil Co. Soya Bean—1,185 tons (bulk), Dairen, Mitsubishi Shoji Kaisha.

OIL SEEDS—Linseed—8,754 bg., Buenos Aires, L. Dreyfus & Co.; 8,320 bg., Buenos Aires, Order; 80,035 bg. and 2,219,671 kilos in bulk, Buenos Aires, Spencer Kellogg & Sons; 54,069 bg., Santa Fe, Order; 25,234 bg., Buenos Aires, Order.

POTASSIUM SALTS — 35 cs. caustic, Gothenburg, Mallinckrodt Chemical Works; 100 bbl. perchlorate, Antwerp, Asia Banking Corp.; 3,500 bg., muriate and 4,000 bg. sulphate, Bremen, Potash Importing Corp. of America; 28 cs. caustic, Gothenburg, Hardy & Ruperti; 18 cs. caustic, Gothenburg, Merck & Co.; 1,640 bg. muriate and a quantity of 20% manure salt, Antwerp, Society Comm. des Potasses d'Alsace; 1,000 bbl. chlorate, Hamburg, Irving Bank-Col. Trust Co.; 500 bbl. chlorate, Hamburg, Mechanics & Metals National Bank; 9,500 bg. sulphate, Hamburg, Potash Importing Corp. of Am.; 1 lot manure, Hamburg, Potash Importing Corp. of Am.; 200 csk. alum, Hamburg, Order; 98 cs. bromide, Hamburg, Mallinckrodt Chem. Works; 9,000 bg. muriate, Hamburg, Order.

PLUMBAGO—200 bbl., Colombo, H. W. Penbody & Co.; 100 bbl., Colombo, Order.

PIGMENT—43 csk. black, Rotterdam, Osborn Co.

PYRIDINE—6 dr. Rotterdam, Lunham & Moore, 6 dr., Antwerp, Meteor Products Co.

QUEBRACHO—709 bg. extract, Buenos Aires, Order; 1,996 bg., Buenos Aires, Guaranty Trust Co.

QUICKSILVER—300 flasks, London, A. H. Pickering; 37 flasks, Tampico, Haas Bros.

SAL AMMONIAC — 33 csk., Hamburg, Order.

SHELLAC—9 cs., Rotterdam, A. Murphy & Co.; 55 bg. garnet, Hamburg, Kasebler-Chatfield Shellac Co.

SODIUM SALTS — 10,635 bg. nitrate, Iquique, E. I. Dupont de Nemours Co.; 168 cs. cyanide, Havre, Asia Banking Corp.; 130 dr. sulphide, Antwerp, E. M. Sergeant & Co.; 360 bg. sulphate, Antofagasta, Kalbfleisch Corp.; 11,234 bg. nitrate, Iquique, W. R. Grace & Co.; 83 dr. sulphide, Liverpool, Order; 4 csk. arsenate, Liverpool, Newport Chemical Co.

SUMAC—200 bbl., Palermo, Order.

TALC—200 bg., Genoa, L. A. Salomon & Bro.

TALLOW—272 tcs., Montevideo, Order.

TARTAR — 120 csk., Naples, Tartar Chem. Works; 9 csk., Naples, C. B. Richard & Co.

VERMILION—4 csk., London, Pomeroy & Fisher.

WOOL GREASE — 90 bbl., Antwerp, Lunham & Moore.

WAXES—16 bg. bees, Cuban ports, R. Desvernine; 34 sk. bees, Valparaiso, Guaranty Trust Co.; 2,000 bg. paraffine, London, Asiatic Petroleum Co.; 10 cs. bees, Rotterdam, Knauth, Nachod & Kuhne; 277 bg. carnauba, Ceara, Lazard Freres; 750 bg. montan, Bremen, Order; 169 bg. carnauba, Ceara, Order; 222 bg. carnauba, Ceara, Lazard Freres.

WHITING—440 bg., Dunkirk, Taintor Trading Co.

WHITE LEAD—100 cs. and 90 bbl. Trieste, Fezandie & Sperrle.

ZINC CHLORIDE — 31 csk., Hamburg, N. J. Zinc Co.

ZINC SULPHATE—3 cs. Liverpool, J. A. McNulty.

ZINC CHLORIDE — 31 csk., Hamburg, Order.

Latest Quotations on Industrial Stocks

	Last Week	This Week
Air Reduction	60	85⅞
Allied Chem. & Dye	65½	65
Allied Chem. & Dye pfd	106½	107
Am. Ag. Chem.	14⅜	10⅜
Am. Ag. Chem. pfd	35¾	32⅜
American Cotton Oil	5	4⅜
American Cotton Oil pfd	16	15
Am. Drug Synd.	5	4½
Am. Linseed Co.	18¼	18½
Am. Linseed pfd.	40	40½
Am. Smelting & Refining	53⅜	54⅜
Am. Smelting & Refining pfd.	93	94⅜
Archer-Daniels Mid. Co., w.i.	29½	28
Archer-Daniels Mid. Co. pfd.	98	98
Atlas Powder	*160	*162
Atlas Powder (new)	54	55
Casein Co. of Am.	*60	*60
Certain-Teed Products	*33½	*35
Commercial Solvents	28	*28
Corn Products	123	117½
Corn Products pfd.	117½	117
Davison Chem.	31⅛	34½
Dow Chem. Co.	*42	*43
Du Pont de Nemours	107	111
Du Pont de Nemours db.	83½	84
Freeport-Texas Sulphur	10	10
Glidden Co.	*7½	7½
Grasselli Chem.	*133	*130
Grasselli Chem. pfd.	*105	*105
Hercules Powder	*105	*105
Hercules Powder pfd	*104	*104
Heyden Chem.	1⅞	1⅞
Int'l Ag. Chem. Co.	3	2⅜
Int'l Ag. Chem. pfd.	11	7
Int'l Nickel	12⅜	12
Int'l Nickel pfd.	82	77½
Int'l Salt	*89½	77
Mathieson Alkali	37½	39
Merck & Co.	*86	*84
National Lead	112¾	108½
National Lead pfd.	110	109½
New Jersey Zinc	153	147
Parke, Davis & Co.	*78	*78
Pennsylvania Salt	*79½	*80
Procter & Gamble	*130	*130
Sherwin-Williams	29	29
Sherwin-Williams pfd.	*101	*102
Tenn. Copper & Chem.	9	8⅜
Texas Gulf Sulphur	57½	54½
Union Carbide	53¾	52
United Drug	78	75½
U. S. Industrial Alcohol	44	45½
U. S. Industrial Alcohol pfd.	*100	*98
Va.-Car. Chem. Co.	6¼	7⅜
Va.-Car. Chem. pfd.	17	22

*Nominal. Other quotations based on last sale.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetone, drums	lb.	$0.25 –	.25½
Acid, acetic, 28%, bbl.	100 lb.	3.38 –	3.50
Acetic, 56%, bbl.	100 lb.	6.75 –	7.00
Glacial, 99½%, bbl.	100 lb.	12.00 –	12.50
Acetic anhydride, 85%, dr.	lb.	.38 –	....
Boric, bbl.	lb.	.10½–	
Citric, kegs	lb.	.49 –	.52
Formic, 85%	lb.	.14 –	.16
Gallic, tech.	lb.	.45 –	.50
Hydrofluoric, 52%, carboys	lb.	.11 –	.12
Lactic, 44%, tech., light, bbl.	lb.	.11½–	.12
22% tech., light, bbl.	lb.	.05½–	.06
Muriatic, 18° tanks	100 lb.	.90 –	1.00
Muriatic, 20°, tanks, 100	lb.	1.00 –	1.10
Nitric, 36°, carboys	lb.	.04½–	.05
Nitric, 42°, carboys	lb.	.06 –	.06½
Oleum, 20%, tanks	ton	18.50 –	19.00
Oxalic, crystals, bbl.	lb.	.12½–	.13
Phosphoric, 50% carboys	lb.	.07½–	.08½
Pyrogallic, resublimed	lb.	1.50 –	1.60
Sulphuric, 60°, tanks	ton	11.00 –	11.00
Sulphuric, 60°, drums	ton	13.00 –	14.00
Sulphuric, 66°, tanks	ton	15.00 –	16.00
Sulphuric, 66° drums	ton	20.00 –	21.00
Tannic, U.S.P., bbl.	lb.	.65 –	.70
Tannic, tech., bbl.	lb.	.45 –	.50
Tartaric, imp., powd., bbl.	lb.	.35 –	.35½
Tartaric, domestic, bbl.	lb.	.37½–	....
Tungstic, per lb.	lb.	1.10 –	1.20
Alcohol, butyl, drums, f.o.b. works	lb.	.26 –	.28
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.78 –	....
Ethyl, 190p'f, U.S.P., bbl.	gal.	4.75 –	....
Alcohol, methyl (see Methanol)			
Alcohol, denatured, 190 proof			
No. 1, special bbl.	gal.	.44 –	...
No. 1, 190 proof, special, dr.	gal.	.38 –	...
No. 1, 188 proof, bbl.	gal.	.45 –	...
No. 1, 188 proof, dr.	gal.	.39 –	...
No. 5, 188 proof, bbl.	gal.	.43 –	...
No 5, 188 proof, dr.	gal.	.37 –	...
Alum, ammonia, lump, bbl.	lb.	.03½–	.03¾
Potash, lump, bbl.	lb.	.02¾–	.03¼
Chrome, lump, potash, bbl.	lb.	.05½–	.05¾
Aluminum sulphate, com., bags	100 lb.	1.50 –	1.65
Iron free bags	lb.	.02½–	.02¾
Aqua ammonia, 26°, drums	lb.	.06½–	.07¼
Ammonia, anhydrous, cyl.	lb.	.30 –	.30½
Ammonium carbonate, powd. casks, imported	lb.	.09½–	.10
Ammonium carbonate, powd. domestic, bbl.	lb.	.13 –	.14
Ammonium nitrate, tech., casks	lb.	.10 –	.11
Amyl acetate tech., drums	gal.	3.75 –	4.25
Arsenic, white, powd., bbl.	lb.	.11½–	.12½
Arsenic, red, powd., kegs	lb.	.15½–	.16
Barium carbonate, bbl.	ton	70.00 –	75.00
Barium chloride, bbl.	ton	80.00 –	83.00
Barium dioxide, drums	lb.	.18 –	.18½
Barium nitrate, casks		.08 –	.08½
Blanc fixe, dry, bbl.	lb.	.04 –	.04¼
Bleaching powder, f.o.b. wks., drums	100 lb.	1.75 –	1.90
Spot N. Y. drums	100 lb.	2.20 –	2.30
Borax, bbl.	lb.	.05½–	.05½
Bromine, cases	lb.	.28 –	.30
Calcium acetate, bags	100 lb.	4.00 –	4.05
Calcium arsenate, dr.	lb.	.14 –	.16½
Calcium carbide, drums	lb.	.05½–	.05¾
Calcium chloride, fused, drums	ton	22.00 –	23.00
Gran. drums	ton	28.00 –	30.00
Calcium phosphate, mono, bbl.	lb.	.06½–	.07
Camphor, cases	lb.	.86 –	.88
Carbon bisulphide, drums	lb.	.07 –	.07½
Carbon tetrachloride, drums	lb.	.09½–	.10
Chalk, precip.—domestic, light, bbl.	lb.	.04½–	.04½
Domestic, heavy, bbl.	lb.	.03½–	.03½
Imported, light, bbl.	lb.	.04½–	.05
Chlorine, liquid, tanks, wks.	lb.	.05½–	.05½
Cylinders, 100 lb., wks	lb.	.06 –	.06¼
Cylinders, 100 lb., spot	lb.	.09 –	....
Chloroform, tech., drums	lb.	.35 –	.38
Cobalt oxide, bbl.	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks	ton	20.00 –	21.00
Copper carbonate, bbl.	lb.	.19 –	.20
Copper cyanide, drums	lb.	.47 –	.50
Copper sulphate, dom., bbl.,	100 lb.	5.50 –	5.75
Imp. bbl.	100 lb.	5.00 –	5.25
Cream of tartar, bbl.	lb.	.25½–	.26½
Epsom salt, dom., tech., bbl.	100 lb.	1.75 –	2.00
Epsom salt, imp., tech., bags	100 lb.	.90 –	1.00
Epsom salt, U.S.P., dom., bbl.	100 lb.	2.00 –	2.50
Ether, U.S.P., resale, dr.	lb.	.13 –	.15
Ethyl acetate, 85%, drums	gal.	.80 –	.81
Ethyl acetate, pure (acetic ether, 98% to 100%)	gal.	.95 –	1.00
Formaldehyde, 40%, bbl.	lb.	$0.14½–	$0.15
Fullers earth—imp., powd., net	ton	30.00 –	32.00
Fusel oil, ref., drums	gal.	... –	...
Fusel oil, crude, drums	gal.	3.75 –	4.00
Glaubers salt, wks., bags	100 lb.	1.20 –	1.40
Glaubers salt, imp., bags	100 lb.	.90 –	.95
Glycerine, c.p., drums extra	lb.	.16½–	.16½
Glycerine, dynamite, drums	lb.	.14½–	....
Glycerine, crude 80%, loose	lb	.09½–	.10
Iodine, resublimed	lb.	4.55 –	4.65
Iron oxide, red, casks	lb.	.12 –	.18
Lead:			
White, basic carbonate, dry, casks	lb.	.09½–	.09¼
White, basic sulphate, casks	lb.	.08½–	.09
White, in oil, kegs	lb.	.11¼–	.12
Red, dry, casks	lb.	.11¼–	.11½
Red, in oil, kegs	lb.	.13 –	.14½
Lead acetate, white crys., bbl.	lb.	.14 –	.14½
Brown, broken, casks	lb.	.13 –	.13½
Lead arsenate, powd., bbl.	lb.	.23 –	.24
Lime-Hydrated, bbl.	per ton	16.80 –	17.00
Lime, Lump, bbl	280 lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.10½–	.10½
Lithophone, bags	lb.	.07 –	.07½
in bbl.	lb.	.07½–	.07¾
Magnesium carb., tech., bags	lb.	.08¼–	.08½
Methanol, 95%, bbl.	gal.	1.18 –	1.20
Methanol, 97%, bbl.	gal.	1.20 –	1.22
Nickel salt, double, bbl.	lb.	.10½–	....
Nickel salts, single, bbl.	lb.	.11½–	....
Phosgene	....	.60 –	.75
Phosphorus, red, cases	lb.	... –	...
Phosphorus, yellow, cases	lb.	.35 –	.40
Potassium bichromate, casks	lb.	.11 –	.11½
Potassium bromide, gran., bbl.	lb.	.19 –	.20
Potassium carbonate, 80-85%, calcined, casks	lb.	.06½–	.06¾
Potassium chlorate, powd.	lb.	.07¼–	.08¼
Potassium cyanide, drums	lb.	.47 –	.52
Potassium, first sorts, cask	lb.	.08	.08¼
Potassium hydroxide (caustic potash) drums	lb.	.07¼–	.09
Potassium iodide, cases	lb.	3.65 –	3.75
Potassium nitrate, bbl.	lb.	.06¼–	.07½
Potassium permanganate, drums	lb.	.17 –	.17½
Potassium prussiate, red, casks	lb.	.65 –	.67
Potassium prussiate, yellow, casks	lb.	.32 –	.34
Salammoniac, white, gran., casks, imported	lb.	.06 –	.06½
Salammoniac, white, gran., bbl., domestic	lb.	.07½–	.07¾
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl.	100 lb.	1 20	1 40
Salt cake (bulk)	ton	26.00 –	28.00
Soda ash, light, 58% flat, bags, contract	100 lb.	1.45 –	1.50
Soda ash, light, 58%, flat, bags, resale	100 lb.	1 70 –	1. 75
Soda ash, dense, bags, contract, basis 58%	100 lb.	1.51 –	....
Soda ash, dense, in bags, resale	100 lb.	1.85 –	1.90
Soda, caustic, 76%, solid, drums	100 lb.	3.16½–	....
Soda, caustic, ground and flake, contracts	100 lb.	3.60 –	3.85
Soda, caustic, ground and flake, resale	100 lb.	3.72½–	....
Sodium acetate, works, bags	lb.	.05½–	.05¾
Sodium bicarbonate, bbl.	100 lb.	2.00 –	2.50
Sodium bichromate, casks	lb.	.08½–	.08½
Sodium bisulphate (niter cake)	ton	6.00 –	7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04½–	.04½
Sodium chlorate, kegs	lb.	.06½–	.07
Sodium chloride	long ton	12.00 –	13.00
Sodium cyanide, cases	lb.	.20 –	.23
Sodium fluoride, bbl.	lb.	$0.08½–	$0.10½
Sodium hyposulphite, bbl.	lb.	.02½–	.03
Sodium nitrite, casks	lb.	.07¾–	.08
Sodium peroxide, powd., cases	lb.	.28 –	.30
Sodium phosphate, dibasic, bbl.	lb.	.03½–	.04
Sodium prussiate, yel. drums	lb.	.14 –	.15½
Sodium salicylic, drums	lb.	.47 –	.52
Sodium silicate (40°, drums)	100 lb.	.75 –	1.15
Sodium silicate (60°, drums)	100 lb.	1.75 –	2.00
Sodium sulphide, fused, 60-62% drums	lb.	.04½–	.04½
Sodium sulphite, crys., bbl.	lb.	.03½–	.03¾
Strontium nitrate, powd., bbl.	lb.	.12½–	.13
Sulphur chloride, yel drums	lb.	.04½–	.05
Sulphur, crude	ton	18.00 –	20.00
At mine, bulk	ton	16.00 –	18.00
Sulphur, flour, bag	100 lb.	2.25 –	2.35
Sulphur, roll, bag	100 lb.	2.00 –	2.10
Sulphur dioxide, liquid, cyl.	lb.	.08 –	.08½
Talc—imported, bags	ton	30.00 –	40.00
Talc—domestic powd., bags	ton	18.00 –	25.00
Tin bichloride, bbl.	lb.	.11½–	.12
Tin oxide, bbl.	lb.	.47 –	...
Tin crystals, bbl.	lb.	.30½–	.31
Zinc carbonate, bags	lb.	.14 –	.14½
Zinc chloride, gran, bbl.	lb.	.06½–	.06½
Zinc cyanide, drums	lb.	.37 –	.38
Zinc oxide, , lead free, bbl.	lb.	.08 –	.08½
5% lead sulphate, bags	lb.	.07½–	.....
10 to 35 % lead sulphate, bags	lb.	.07 –	.....
French, red seal, bags	lb.	.09½–	.....
French, green seal, bags	lb.	.10½–	.....
French, white seal, bbl.	lb.	.12 –	.....
Zinc sulphate, bbl.	100 lb.	2.50 –	3.00

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.62 –	$0.75
Alpha-naphthol, ref., bbl.	lb.	.70 –	.80
Alpha-naphthylamine, bbl.	lb.	.35 –	.37
Aniline oil, drums	lb.	.16 –	.16½
Aniline salts, bbl.	lb.	.23 –	.24
Anthracene, 80%, drums	lb.	.75 –	1.00
Anthracene, 80%, imp., drums, duty paid	lb.	.70 –	.75
Anthraquinone, 25%, paste, drums	lb.	.70 –	.75
Benzaldehyde U.S.P., carboys	lb.	1.40 –	1.45
tech., drums	lb	75	.....
Benzene, pure, water-white, tanks and drums	gal.	.27 –	.32
Benzene, 90%, tanks & drums	gal.	.25 –	.30
Benzene, 90%, drums, resale	gal.	.28 –	.32
Benzidine base, bbl.	lb.	.80 –	.85
Benzidine sulphate, bbl.	lb.	.70 –	.75
Benzoic acid, U.S.P., kegs	lb.	.75 –	.80
Benzoate of soda, U.S.P., bbl.	lb.	.57 –	.65
Benzyl chloride, 95-97%, ref., drums	lb.	.45 –	...
Benzyl chloride, tech., drums	lb.	.30 –	.35
Beta-naphthol, tech., bbl.	lb.	.21 –	.22
Beta-naphthylamine, tech.	lb.	.80 –	.90
Cresol, U.S.P., drums	lb.	.25 –	.29
Ortho-cresol, drums	lb.	.28 –	.32
Cresylic acid, 97%, resale, drums	gal.	1.00 –	.....
95-97%, drums, resale	gal.	.95 –	.....
Dichlorbenzene, drums	lb.	.07 –	.09
Diethylaniline, drums	lb.	.50 –	.60
Dimethylaniline, drums	lb.	.41 –	.42
Dinitrobenzene, bbl.	lb.	.19 –	.20
Dinitroclorbenzenee bbl.	lb.	.22 –	.23
Dinitronaphthalen, bbl.	lb.	.30 –	.32
Dinitrophenol, bbl.	lb.	.35 –	.40
Dinitrotoluene, bbl.	lb.	.20 –	.22
Dip oil, 25%, drums	gal.	.25 –	.30
Diphenylamine, bbl.	lb.	.50 –	.52
H-acid, bbl.	lb.	.75 –	.80
Meta-phenylenediamine, bbl.	lb.	1.00 –	1.05
Michlers ketone, bbl.	lb.	3.00 –	3.50
Monochlorbenzene, drums	lb.	.08 –	.10
Monoethylaniline, drums	lb.	.95 –	1.10
Naphthalene, flake, bbl.	lb.	.07½–	.07½
Naphthalene, balls, bbl.	lb.	.07½–	.08
Naphthionate of soda, bbl.	lb.	.58 –	.65
Naphthionic acid, crude, bbl.	lb.	.55 –	.60
Nitrobenzene, drums	lb.	.10 –	.12
Nitro-naphthalene, bbl.	lb.	.30 –	.35
Nitro-toluene, drums	lb.	.13½–	.14½
N-W acid, bbl.	lb.	1.25 –	1.30
Ortho-amidophenol, kegs	lb.	2.30 –	2.35
Ortho-dichlorbenzene, drums	lb.	.17 –	.20
Ortho-nitrophenol, bbl.	lb.	.90 –	.92
Ortho-nitrotoluene, drums	lb.	.10 –	.12
Ortho-toluidine, bbl.	lb.	.13½–	.14½
Para-amidophenol, base, kegs	lb.	1.20 –	1.30
Para-amidophenol, HCl, kegs	lb.	1.25 –	1.35
Para-dichlorbenzene, bbl.	lb.	.17 –	.20
Paranitroaniline, bbl.	lb.	.70 –	.75
Para-nitrotoluene, bbl.	lb.	.60 –	.65
Para-phenylenediamine, bbl.	lb.	1.45 –	1.50
Para-toluidine, bbl	lb.	.90 –	.95
Phthalic anhydride, bbl.	lb.	.35 –	.38
Phenol, U.S.P., resale, dr.	lb.	.38 –	.42
Picric acid, bbl.	lb.	.20 –	.22
Pyridine, dom., drums	gal.	nominal	

Pyridine, imp., drums	gal.	$4.00 –	$4.25
Resorcinol, tech., kegs	lb.	1.50 –	1.60
Resorcinol, pure, kegs	lb.	2.25 –	..
R-salt, bbl	lb.	.55 –	.60
Salicylic acid, tech., bbl	lb.	.37 –	.42
Salicylic acid, U.SP., bbl	lb.	.40 –	....
Solvent naph.ha, water-white, tanks.t	gal.	.27 –	....
Crude, tanks	gal.	.24 –	....
Sulphanilic acid, crude, bbl	lb.	.18 –	.20
Thiocarbanilide, kegs	lb.	.35 –	.38
Toluidine, kegs	lb.	1.20 –	1.30
Toluidine, mixed, kegs	lb.	.30 –	.35
Toluene, tank cars	gal.	.30 –	.32
Toluene, drums	gal.	.34 –	.36
Xylidines drums	lb.	.49 –	.50
Xylene, pure, drums	gal.	.65 –	.90
Xylene, com., drums	gal.	.37 –	.....
Xylene, com., tanks	gal.	.32 –	.....

Naval Stores

Rosin B-D, bbl. 280 lb.		$5.80 –	....
Rosin E-I, bbl. 280 lb.		5.85 –	....
Rosin K-N, bbl. 280 lb.		6.00 –	6.10
Rosin W.G.-W.W., bbl. 280 lb.		6.25 –	7.25
Wood rosin, bbl. 280 lb.		5.90 –	6.00
Turpentine, spirits of, bbl	gal.	.93 –	.94
Wood, steam dist., bbl	gal.	.82 –	.83
Wood, dest. dist., bbl	gal.	.62 –	.63
Pine tar pitch, bbl. 200 lb.		..... –	6.00
Tar, kiln burned, bbl. 500 lb.		..... –	13.00
Retort tar, bbl. 500 lb.		..... –	12.00
Rosin oil, first run, bbl	gal.	.45 –	.....
Rosin oil, second run, bbl	gal.	.48 –	.....
Rosin oil, third run, bbl	gal.	.52 –	.....
Pine oil, steam dist	gal.	.70 –	.....
Pine oil, pure, dest. dist	gal.	.65 –	.....
Pine tar oil, ref	gal.	.48 –	.....
Pine tar oil, crude, tanks f.o.b. Jacksonville, Fla	gal.	.32 –	.32½
Pine tar oil, double ref., bbl	gal.	..... –	.75
Pine tar, ref., thin, bbl	gal.	..... –	.25
Pinewood creosote, ref., bbl.	gal.	..... –	.52

Animal Oils and Fats

Degras, bbl	lb.	$0.03½ –	$0.04½
Grease, yellow, bbl	lb.	.05½ –	.06
Lard oil, Extra No. 1, bbl	gal.	.90 –	.92
Neatsfootoil 20 deg. bbl	gal.	1.30 –	....
No. 1, bbl	gal.	.92 –	.94
Oleo Stearine	lb.	.08 –	....
Red oil, distilled, d.p. bbl	lb.	.09½ –	.10
Saponified, bbl	lb.	.09½ –	.10
Tallow, extra, loose	lb.	.06½ –	....
Tallow oil, acidless, bbl	gal.	.94 –	.96

Vegetable Oils

Castor oil, No. 3, bbl	lb.	$0.14 –	.....
Castor oil, No. 1, bbl	lb.	.14½ –	.....
Chinawood oil, bbl	lb.	.25 –	.25½
Coconut oil, Ceylon, bbl	lb.	.09½ –	.09¾
Ceylon, tanks, N.Y	lb.	.08 –	.08¼
Coconut oil, Cochin, bbl	lb.	.09¾ –	.09¾
Corn oil, crude, bbl	lb.	.10 –	10½
Crude, tanks, (f.o.b. mill)	lb.	.08½ –	.08½
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08½ –	09
Summer yellow, bbl	lb.	.11½ –	.....
Winter yellow, bbl	lb.	.12½ –	.....
Linseed oil, raw, car lots, bbl.	gal.	1.08 –	.....
Raw, tank cars (dom.)	gal.	1.03 –	.....
Boiled, cars, bbl. (dom.)	gal.	1.10 –	.....
Olive oil, denatured, bbl	gal.	1.05 –	1.10
Sulphur, (foots) bbl	lb.	.08¼ –	.08¼
Palm, Lagos, casks	lb.	.07 –	.....
Niger, casks	lb.	.06½ –	.....
Palm kernel, bbl	lb.	.08½ –	.08¼
Peanut oil, crude, tanks (mill)	lb.	.11½ –	...
Peanut oil, refined, bbl	lb.	.15½ –	16
Perilla, bbl	lb.	.15½ –	.15½
Rapeseed oil, refined, bbl	gal.	.78 –	...
Rapeseed oil, blown, bbl	gal.	.85 –	...
Sesame, bbl	lb.	.11½ –	.11¾
Soya bean (Manchurian), bbl.	lb.	.10¾ –	.11
Tank, f.o.b. Pacific coast	lb.	.09 –	.....
Tank, (f.o.b. N.Y.)	lb.	.09¼ –	.....

Fish Oils

Cod, Newfoundland, bbl	gal.	$0.65 –	.....
Menhaden, light pressed, bbl.	gal.	.76 –	.....
White bleached, bbl	gal.	.78 –	.....
Blown, bbl	gal.	.82 –	.....
Crude, tanks (f.o.b. factory)	gal.	.45 –	.50
Whale No. 1 crude, tanks, coast	lb.	..... –	.....
Winter, natural, bbl	gal.	.76 –	.78
Winter, bleached bbl	gal.	.79 –	.80

Oil Cake and Meal

Coconut cake, bags	ton	$26.00 –	$28.00
Copra, sun dried, bags, (c.i.f.)	lb.	.05 –	....
Sun dried Pacific coast	lb.	.04½ –	.04¾
Cottonseed meal, f.o.b. mills	ton	38.00 –	....
Linseed cake, bags	ton	36.00 –	....
Linseed meal, bags	ton	38.00 –	....

Dye & Tanning Materials

Albumen, blood, bbl	lb.	$0.45 –	$0.50
Albumen, egg, tech, kegs	lb.	.95 –	.97
Cochneal, bags	lb	.33 –	.35
Cutch, Borneo, bales	lb.	.04½ –	.04½
Cutch, Rangoon, bales	lb.	.13 –	.13
Dextrine, corn, bags 100 lb.		3.79 –	4.06
Dextrine gum, bags 100 lb.		4.14 –	4.34
Divi-divi, bags	ton	38.00 –	39.00
Fustic, sticks	ton	30.00 –	35.00
Fustic, chips, bags	lb.	.04 –	.05
Logwood, sticks	ton	26.00 –	30.00
Logwood, chips, bags	lb.	.02½ –	.03½
Sumac, leaves, Sicily, bags	ton	70.00 –	72.00
Sumac, ground, bags	ton	$55.00 –	$67.00
Sumac, domestic, bags	ton	40.00 –	42.00
Starch, corn, bags 100 lb.		3.22 –	3.49
Tapioca flour, bags	lb.	.07 –	.07½

Extracts

Archil, cone., bbl	lb.	$0.18 –	$0.22
Chestnut, 25% tannin, tanks	lb.	.02 –	.03
Divi-divi, 25% tannin, bbl	lb.	.04 –	.05
Fustic, crystals, bbl	lb.	.20 –	.22
Fustic, liquid, 42°, bbl	lb.	.08 –	.09
Gambier, liq., 25% tannin, bbl.	lb.	.08 –	.09
Hematine crys., bbl	lb.	.14 –	.18
Hemlock, 25% tannin, bbl	lb.	.03¾ –	.04¾
Hypernic, solid, drums	lb.	.24 –	.26
Hypernic, liquid, 51°, bbl	lb.	.09½ –	.10½
Logwood, crys., bbl	lb.	.17 –	.18
Logwood, liq., 51°, bbl	lb.	.08½ –	.09
Quebracho, solid, 65% tannin, bbl	lb.	.04½ –	.05
Sumac, dom., 51°, bbl	lb.	.06½ –	.07

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, spot	lb.	$0.18 –	$0.22
Lampblack, bbl	lb.	.12 –	.40
Mineral, bulk	ton	35.00 –	45.00
Blues–Bronze, bbl	lb.	.55 –	.60
Prussian, bbl	lb.	.55 –	.60
Ultramarine, bbl	lb.	.08 –	.35
Browns, Sienna, Ital., bbl	lb.	.06 –	.14
Sienna, Domestic, bbl	lb.	.03½ –	.04
Umber, Turkey, bbl	lb.	.04 –	.04½
Greens–Chrome, C.P.Light, bbl	lb.	.32 –	.34
Chrome, commercial, bbl	lb.	.12 –	.12½
Paris, bulk	lb.	.25 –	.28
Reds, Carmine No. 40, tins	lb.	4.50 –	4.70
Oxide red, casks	lb.	.10 –	.14
Para toner, kegs	lb.	1.00 –	1.10
Vermilion, English, bbl	lb.	1.25 –	1.28
Yellow, Chrome, C.P. bbls	lb.	.21 –	.22
Ocher, French, casks	lb.	.02½ –	.03

Waxes

Bayberry, bbl	lb.	$0.30 –	$0.32
Beeswax, crude, bags	lb.	.21½ –	.22½
Beeswax, refined, light, bags	lb.	.32 –	.34
Beeswax, pure white, cases	lb.	.40 –	.41
Candellila, bags	lb.	.20 –	.21
Carnauba, No. 1, bags	lb.	.42 –	.43
No. 2, North Country, bags	lb.	.23 –	.23½
No. 3, North Country, bags	lb.	.17½ –	.18½
Japan, cases	lb.	.16 –	.16½
Montan, crude, bags	lb.	.04½ –	.04¾
Paraffine, crude, match, 105-110 m.p.	lb.	.04 –	.04¼
Crude, scale 124-126 m.p., bags	lb.	.02½ –	.03
Ref., 118-120 m.p., bags	lb.	.03 –	.03½
Ref., 125 m.p., bags	lb.	.03½ –	.03¾
Ref. 128-130 m.p., bags	lb.	.03¾ –	.03¾
Ref., 133-135 m.p., bags	lb.	.04½ –	.04½
Ref., 135-137 m.p., bags	lb.	.05½ –	.05½
Stearic acid, agle pressed, bags	lb.	.12½ –	.13
Double pressed, bags	lb.	.13½ –	.13½
Triple pressed, bags	lb.	.14½ –	.14½

Fertilizers

Ammonium sulphate, bulk, f.o.b. works 100 lb.		$3.20 –	$3.25
F.a.s. double bags 100 lb.		3.55 –	3.65
Blood, dried, bulk	unit	4.00 –	.....
Bone, raw, 3 and 50, ground	ton	27.00 –	30.00
Fish scrap, dom., dried, wks	unit	3.75 –	.....
Nitrate of soda, bags 100 lb.		2.45 –	2.52½
Tankage, high grade, f.o.b. Chicago	unit	3.40 –	3.50
Phosphate rock, f.o.b. mines, Florida pebble, 68-72%	ton	$4.00 –	$4.50
Tennessee, 78-80%	ton	8.00 –	8.25
Potassium muriate, 80%, bags	ton	34.55 –	.....
Potassium sulphate, bags basis 90%	ton	43.67 –	.....
Double manure salt	ton	25.72 –	.....
Kainit	ton	7.22 –	.....

Crude Rubber

Para—Upriver fine	lb.	$0.26½ –	.....
Upriver coarse	lb.	.24 –	.....
Upriver caucho ball	lb.	.24½ –	.....
Plantation—First latex crepe	lb.	.24½ –	.....
Ribbed smoked sheets	lb.	.25 –	.....
Brown crepe, thin, clean	lb.	.24½ –	.....
Amber crepe No. 1	lb.	.24½ –	.....

Gums

Copal, Congo, amber, bags	lb.	$0.12 –	$0.13
East Indian, bold, bags	lb.	.23 –	.23½
Manila, pale, bags	lb.	.20 –	.20½
Pontinak, No. 1 bags	lb.	.20 –	.20½
Damar, Batavia, cases	lb.	.27½ –	.28
Singapore, No. 1, cases	lb.	.32 –	.33
Singapore, No. 2, cases	lb.	.21½ –	.22
Kauri, No. 1, cases	lb.	.65 –	.67
Ordinary chips, cases	lb.	.21 –	.22
Manjak, Barbados, bags	lb.	.09 –	.09½

Shellac

Shellac, orange fine, bags	lb.	$0.56 –	.....
Orange superfine, bags	lb.	.58 –	.....
A. C. garnet, bags	lb.	.56 –	.....
Bleached, bonedry	lb.	.65 –	.67
Bleached, fresh	lb.	.53 –	.55
T. N., bags	lb.	.52 –	.53

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b., Quebec	sh. ton	$100.00 –	.....
Asbestos, shingle, f.o.b., Quebec	sh. ton	$65.00 –	$85.00
Asbestos, cement, f.o.b., Quebec	sh. ton	20.00 –	25.00
Barytes, grd., white, f.o.b. mills, bbl	net ton	16.00 –	20.00
Barytes, grd., off-color, f.o.b. mills bulk	net ton	13.00 –	15.00
Barytes, floated, f.o.b. St. Louis, bbl	net ton	28.00 –	.....
Barytes, crude f.o.b. mines, bulk	net ton	10.00 –	11.00
Casein, bbl., tech	lb.	15½ –	.17
China clay (kaolin) crude, f.o.b. Ga	net ton	7.00 –	9.00
Washed, f.o.b. Ga	net ton	8.00 –	9.00
Powd., f.o.b. Ga	net ton	14.00 –	20.00
Crude f.o.b. Va	net ton	7.00 –	9.00
Ground, f.o.b. Va	net ton	13.00 –	19.00
Imp., lump, bulk	net ton	15.00 –	20.00
Imp., powd	net ton	45.00 –	50.00
Feldspar, No. 1 pottery	long ton	6.00 –	7.00
No. 2 pottery	long ton	4.00 –	5.50
No. 1 soap	long ton	7.00 –	7.50
No. 1 Canadian, f.o.b. mill	long ton	20.00 –	22.00
Graphite, Ceylon, lump, first quality, bbl	lb.	.06½ –	.....
Ceylon, chip, bbl	lb.	.05½ –	.....
High grade amorphous crude	ton	15.00 –	35.00
Gum arabic, amber, sorts, bags	lb.	.14½ –	.15
Gum tragacanth, sorts, bags	lb.	.48 –	.56
No. 1, bags	lb.	1.50 –	1.60
Kieselguhr, f.o.b. Cal	ton	40.00 –	42.00
F.o.b. N. Y	ton	50.00 –	55.00
Magnesite, crude, f.o.b. Cal	ton	14.00 –	15.00
Pumice stone, imp., casks	lb.	.03 –	.05½
Dom., lump, bbl	lb.	.05 –	.05½
Dom., ground, bbl	lb.	.06 –	.07
Silica, glass sand, f.o.b. Ind	ton	2.00 –	2.50
Silica, sand blast, f.o.b. Ind	ton	2.50	5.00
Silica, amorphous, 250-mesh, f.o.b. Ill	ton	17.00 –	17.50
Silica, bldg. sand, f.o.b. Pa	ton	2.00 –	2.75
Soapstone, coarse, f.o.b. Vt., bags	ton	7.00 –	8.00
Talc, 200 mesh, f.o.b., Vt., bags	ton	6.50 –	9.00
Talc, 200 mesh, f.o.b. Ga., bags	ton	7.00 –	9.00
Talc, 200 mesh, f.o.b. Los Angeles, bags	ton	16.00 –	20.00

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$3.00 –	3.25
Corning	bbl.	1.70 –	.....
Cabell	bbl.	1.71 –	.....
Somerset	bbl.	1.55 –	.....
Illinois	bbl.	1.97 –	.....
Indiana	bbl.	1.98 –	.....
Kansas and Oklahoma, 28 deg.	bbl.	1.20 –	.....
California, 35 deg. and up	bbl.	1.04 –	.....

Gasoline, Etc.

Motor gasoline, steel bbls	gal.	$0.21½ –	.....
Naphtha, V. M. & P. deod, steel bbls	gal	.20½ –	.....
Kerosene, ref. tank wagon	gal.	.14 –	.....
Bulk, W. W. export	gal.	.05½ –	.....
Lubricating oils:			
Cylinder, Penn., dark	gal.	.20 –	.22
Bloomless, 30@31 grav	gal.	.18½ –	.20½
Paraffin, pale	gal.	.24 –	.26
Spindle, 200, pale	gal.	.21 –	.22
Petrolatum, amber, bbls	lb.	.05 –	.05½
Paraffine wax (see waxes)			

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	ton	$45–50
Chrome brick, f.o.b. Eastern shipping points	ton	50–52
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks	1,000	40–46
2nd. quality, 9-in. shapes, f.o.b. wks	1,000	36–41
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65–68
9-in. arches, wedges and keys	ton	80–85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48–50
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	48–50
F.o.b. Mt. Union, Pa	1,000	42–44
Silicon carbide refract. brick, 9-in.	1,000	1,100.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N.Y.	ton	$200.00 –	$225.00
Ferrochromium, per lb. of Cr, 6-8% C	lb.	.11½	.11¾
4-6% C	lb.	.12 –	.13
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	125.00 –	.....
Spiegeleisen, 19-21% Mn	gr. ton	40.00 –	.....
Ferromolybdenum, 50-60% Mo, per lb Mo	lb.	2.00 –	...
Ferrosilicon, 10-15%	gr. ton	48.00 –	50.00
50%	gr. ton	95.00 –	.....
75%	gr. ton	150.00 –	160.00

Ferrotungsten, 70-80%, per lb. of W	lb.	$0.88 - $0.90
Ferro-uranium, 35-50% of U. per lb. of U	lb.	4.50 -
Ferrovanadium, 30-40%, per lb. of V	lb.	3.50 - 3.75

Ores and Semi-finished Products

Bauxite, dom. crushed dried, f.o.b. shipping points	ton	$6.00 - $9.00
Chrome ore Calif. concentrates, 50% min. Cr_2O_3.	ton	22.00 - 23.00
C.i.f. Atlantic seaboard	ton	20.50 - 24.00
Coke, fdry., f.o.b. ovens	ton	5.75 - 6.25
Coke, furnace, f.o.b. ovens	ton	5.50 - 6.00
Fluorspar, gravel, f.o.b. mines' Illinois	ton	20.00 - 21.50
Ilmenite, 52% TiO_2	lb.	.01½ - .01¾
Manganese ore, 50% Mn c.i.f. Atlantic seaport	unit	.35 -
Manganese ore, chemica (MnO_2)	ton	80.00 - 85.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.65 - .70
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 - .08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½ - .12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.11½ - .12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12
Rutile, 95% TiO_2	lb.	.12 -
Tungsten, scheelite, 60% WO_3 and over, per unit WO_3	unit	8.50 - 8.75
Tungsten, wolframite, 60% WO_3 and over, per unit WO_3	unit	8.00 - 8.25
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 - 3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	2.25 - 2.50
Vanadium pentoxide, 99%	lb.	12.00 - 14.00
Vanadium ore, per lb. V_2O_5	lb.	.75 - 1.00
Zircon, washed, iron free, f.o.b. Pablo, Fla.	lb.	.02½ - .10

Non-Ferrous Materials

	Cents per Lb
Copper, electrolytic	14½
Aluminum, 98 to 99%	26-27½
Antimony, wholesale, Chinese and Japanese	7- 7½
Nickel, virgin metal	27-29
Nickel, ingot and shot	30-32
Monel metal, shot and blocks	32.00
Monel metal, ingots	38.00
Monel metal, sheet bars	45.00
Tin, 5-ton lots, Straits	37.37½
Lead, New York, spot	6.35
Lead, E. St. Louis, spot	6.00
Zinc, spot, New York	6.15
Zinc, spot, E. St. Louis	5.80

Other Metals

Silver (commercial)	oz.	$0.62½
Cadmium	lb.	1.00
Bismuth (500 lb. lots)	lb.	2.55
Cobalt	lb.	3.00-3.25
Magnesium, ingots, 99%	lb.	1.25-
Platinum	oz.	116.00
Iridium	oz.	275.00@360.00
Palladium	oz.	80.00
Mercury	75 lb.	68.00

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	22.75
Copper bottoms	29.25
Copper rods	23.00
High brass wire	19.50
High brass rods	17.50
Low brass wire	21.10
Low brass rods	22.00
Brazed brass tubing	24.25
Brazed bronze tubing	29.00
Seamless copper tubing	26.50
Seamless high brass tubing	25.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

Copper, heavy and crucible	10.25@10.50
Copper, heavy and wire	11.25@11.35
Copper, light and bottoms	10.25@10.50
Lead, heavy	5.00@5.75
Lead, tea	3.25@3.50
Brass, heavy	6.25@6.50
Brass, light	5.00@5.75
No. 1 yellow brass turnings	6.25@6.35
Zinc scrap	3.25@3.50

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.64	$3.64
Soft steel bars	3.54	3.54
Soft steel bar shapes	3.54	3.54
Soft steel bands	4.39	4.39
Plates, ¼ to 1 in. thick	3.64	3.64

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Alabama

CALERA—O'Neals Lime Works, Inc., Lincoln Life Bldg., Birmingham, has work in progress on the first unit of its new plant on property recently acquired at Calera, and will commence the erection of other units at an early date. A total of 10 kilns will be installed, each with capacity of about 40 tons per day. Extensive limestone properties will be developed in this section and an automatic conveyor system installed to reach to the plant. The entire works is estimated to cost close to $500,000, including machinery. John H. Adams is president, and Albert Stradford, secretary-treasurer.

Arizona

MESA—The Attaway-Phelps Cotton Co. has tentative plans for the construction of a new cotton oil mill on local site, estimated to cost about $50,000, including equipment. E. G. Attaway heads the company.

California

LOS ANGELES—Gladding, McBean & Co., Crocker Bldg., San Francisco, have acquired the plant and property of the Tropico Potteries, Inc., Tropico, near Los Angeles, specializing in the manufacture of drain tile, ornamental tile, terra cotta, etc., with raw material lands in the vicinity of Corona and Elsinore. It is said that a consideration of about $1,000,000 was given. The new owners will take over the plant at once, and continue in the same line of manufacture, utilizing the output for Southern trade. Extensions and improvements are under consideration.

TORRANCE—The Western Sheet Glass Co. has purchased the plant and business of the Torrance Glass Co., and will take over the property immediately for the manufacture of sheet glass specialties, including plate, art and wire glass products. Plans are under way for extensions and improvements, including the installation of additional equipment, estimated to cost about $1,000,000. Adolph Sieroty, R. H. Raphael and Charles Bisby.

LOS ANGELES—The General Petroleum Co., Higgins Bldg., is considering plans for the construction of a new oil storage and distributing plant on Terminal Island, San Pedro Harbor, to cost in excess of $1,500,000, including equipment.

Kansas

KANSAS CITY—The Kansas City Refining Co., Troy and 4th Sts., has tentative plans under consideration for the construction of an addition to its local oil-refining plant to cost approximately $100,000, with equipment. E. W. Goebell is general manager.

WICHITA—The Derby Oil & Refining Co. has work in progress on its second new refinery unit and purposes to have the extension ready for service during the summer. The unit will have a capacity of 1,200 bbl. per day, increasing the plant output to 6,000 bbl. daily. The company has recently completed a new addition with similar capacity rating and will develop to maximum at once. A plant investment of about $500,000 is being made.

Kentucky

ASHLAND—The Ironton Stove Co. is perfecting plans for the erection of an addition to its plant to be equipped as an enameling department. The company has recently increased its capital for expansion.

Louisiana

MONROE—The Brown Paper Co., Inc., recently organized with a capital of $1,000,000, has acquired a tract of land at West Monroe, with extensive pine properties, and plans for the erection of a new pulp and paper mill to develop an initial capacity of 150 tons of material in 24 hours. It is estimated to cost close to $1,000,000, and will include a power plant and other mechanical structures. The company previously secured a site near Bastrop, La., for the proposed mill, but such project, it is said, will be abandoned. H. L. Brown, Orange, Tex., is president.

SHREVEPORT—The Caddo-DeSoto Cotton Oil Co. has awarded a contract to W. H. Wewer, Shreveport, for the rebuilding of the portion of its local plant, destroyed by fire a short time ago. It will be 1-story, 60x325 ft., with adjoining structure, 80x200 ft., for general operating service and storage. The plant will have a daily capacity for handling 225 tons of cotton seed. M. O. Stockbridge is vice-president.

Maryland

BALTIMORE—The Chieftain Mfg. Co., 154 Nassau St., New York, manufacturer of shoe polishes, etc., has acquired a plot of land on the Key Highway and Jackson St., with existing building. The structure will be remodeled and improved for a new plant. It is purposed to remove the present works at Charleston, W. Va., to the new location and increase the capacity. J. S. Steele is president.

Massachusetts

WORCESTER—The Graton & Knight Mfg. Co., manufacturer of leather products, has work under way on improvements and extensions in its tanning plant, estimated to cost $50,000.

PEABODY—The Greiss-Pfleger Tanning Co., Sycamore Ave., Cincinnati, O., is taking bids for the construction of a 1-story addition to its local tannery, including the installation of additional equipment, estimated to cost approximately $75,000.

FALL RIVER—The New England Oil Refining Co., New St., will build a 1-story laboratory, 32x42 ft. Plans have been completed.

Michigan

CALUMET—The Mohawk Mining Co. has construction under way on an addition to its mill, to be equipped with regrinding machinery, tables and auxiliary equipment.

Missouri

KANSAS CITY—The Continental Paper & Bag Mills, Inc., 16 East 40th St., has leased a building at 12th and Mulberry Sts., and will establish a branch plant for the manufacture of a line of paper products. Possession will be taken at once and necessary equipment installed.

JOPLIN—The Quapaw Mining Co., recently merged with the Chubb Mining Co., is planning for the installation of equipment for the development of extensive lead and zinc properties in this section. The company has a tract of more than 2,000 acres. T. F. Lennan is president and general manager.

Nevada

RENO—The Redwood Lumber Co. has negotiations under way with the local Chamber of Commerce for the establishment of a plant on site to be selected for the production of sulphur. The company has raw material properties at Sulphur, in the vicinity of Gerlach, Nev. The proposed local plant will cost in excess of $50,000.

New Jersey

TRENTON—The Combination Rubber Co., Franklin St., Bloomfield, N. J., manufacturer of automobile tires and mechanical rubber goods, will commence the construction of a new plant on Mead St., Trenton, 80x280 ft., designed to more than double its present plant capacity. It is planned to remove the Bloomfield works to the new location. The new plant will cost more than $70,000. Fred L. Conover is treasurer.

MATAWAN—Fire, June 28, destroyed a portion of the plant of the Po-Amboy Chemical Co., Lloyd Rd., Matawan Township. An estimate of loss has not been announced.

MILLVILLE — The Whitall-Tatum Co., 46 Barclay St., New York, manufacturer of bottles, vials, etc., is arranging plans for the rebuilding of the portion of its local plant, destroyed by fire a number of months ago. The work will proceed as soon as the regular seasonal shut-down becomes operative at the end of July, when new automatic blowing machines and auxiliary equipment will be installed. The wood mold department at the works will be discontinued.

New York

NIAGARA FALLS—The International Paper Co., 30 Broad St., New York, will soon commence the erection of a 1-story addition to its local mill on Buffalo Ave., 80x160 ft., estimated to cost $22,000.

ROCHESTER—The Don-O-Lac Co., Inc., 770 Exchange St., is reported to be arranging for the rebuilding of the portion of its paint and chemical works, destroyed by fire, June 25, with loss estimated at $50,000.

NEW YORK—The Commercial Solvents Co., 17 East 42nd St., has commenced the remodeling of its new plant at Peoria, Ill., comprising the former factory of the United States Food Products Co., recently acquired. It is expected to install complete equipment at an early date. The company recently arranged an appropriation of $1,000,000 for the construction of a new plant and this fund will now be used in connection with the purchase and machinery for the Peoria works.

North Carolina

WILMINGTON—The Nitrate Agencies Co., 104 Pearl St., New York, has acquired a local building and will install equipment for the manufacture of commercial fertilizer products. A. C. Diehl is local manager.

Ohio

SANDUSKY—The Ajax Rubber Co., Breunig Ave., Trenton, N. J., manufacturer of automobile tires, etc., is extending an agreement made with the local Chamber of Commerce for the erection of a new plant on site selected, for a period of 12 months. The company purposes to build within this time, with estimated cost of plant placed at $1,000,000.

Oklahoma

ARDMORE—The Santa Fe Oil & Refining Co., operating the former oil refinery of the Chickasaw Refining Co., lately purchased, is perfecting plans for extensions in the plant, to include the installation of new process stills and other equipment, estimated to cost $300,000.

Pennsylvania

TRAINER—The Sinclair Refining Co., 45 Nassau St., New York, has taken bids for the construction of four buildings for a local refinery, and plans to commence construction at an early date.

PITTSBURGH — The Conroy-Prugh Co., Western Ave., manufacturer of glass products, has filed plans and will commence the immediate construction of a new addition to its plant at 1414-18 Western Ave., estimated to cost about $80,000, including equipment.

PHILADELPHIA — E. Stanley Perkins, Wayne Ave. and Bristol St., manufacturer of glazed kid, has plans under way for the erection of a new plant addition. R. Brognard Okie, Crozer Bldg., is architect.

RANKIN—The Copper Clad Steel Co., manufacturer of welded copper, brass, steel and other metal products, has tentative plans under consideration for the rebuilding of the portion of its plant destroyed by fire, June 24, with loss estimated at $75,000. The foundry and plant of the Acheson Mfg. Co., adjoining, manufacturer of iron castings, etc., was also partly destroyed, with like loss, and it is also purposed to rebuild this works at an early date.

PHILADELPHIA—The American Chemical Paint Co., 1126 South 11th St., has had plans prepared for the erection of a new plant on site at Ambler, Pa. It is expected to break ground at an early date.

LUCINDA—Fire, June 24, destroyed a portion of the tankage and operating department at the local plant of the Lucinda Refining Co., with loss reported at $50,000. It is planned to rebuild.

Tennessee

MEMPHIS—The Crescent Cotton Oil Co. has plans in preparation for the rebuilding of the portion of its plant recently destroyed by fire. The estimated loss has not been announced. Alston Ray is president.

Texas

CORSICANA—The Humble Oil & Refining Co., Houston, has acquired a local tract of about 115 acres of land as a site for a new oil storage and distributing plant, with total capacity of more than 1,500,000 bbl. It will cost in excess of $250,000, with equipment.

Washington

HILLYARD—The Evergreen Refinery Co., recently organized, has acquired a tract of 50 acres of land at Hillyard, near Spokane, as a site for a new oil-refining plant. Plans are under way for the initial plant unit estimated to cost about $200,000, including tankage department. J. P. Graves, Spokane; and J. F. McCarthy, Wallace, Idaho, are at the head of the company.

West Virginia

NITRO—The Federal Chemical Co. has tentative plans under consideration for the establishment of a new local plant for the production of industrial alcohol. George Appell is general manager.

WHEELING—The Wheeling Tile Co. has plans for the construction of a new 1-story plant and kiln on Wood St., to be 60x100 ft., estimated to cost $16,000, exclusive of equipment.

Industrial Notes

CHARLES ALMY, JR., vice-president of Dewey & Almy Chemical Co., Cambridge, Mass., is now in England on an extended sales trip which will take him to France and Spain. He has concluded negotiations with Joseph Rhodes & Sons, Ltd., Wakefield, England, to act as agent for Dewalco products in England. Mr. Almy plans to return to this country during August.

THE FOXBORO CO., INC., Foxboro, Mass., announces that A. F. Mundy, formerly of the Chicago office, will represent the company in southern California, with offices at Pacific Finance Bldg., Los Angeles. Announcement is also made that C. Roessner has been appointed district sales manager at Chicago, with offices at 1510 Monadnock Bldg.

MR. VORIS, a graduate of Pennsylvania State College and since then a chemist with the Milton Mfg. Co., Milton, Pa., has recently purchased the laboratory of the R. S. Haff Co., of Hagerstown, Pa., and is now prepared to make commercial analysis of all products.

The name of the ELECTRIC STEEL CO., Chicago, was changed to Nugent Steel Castings Co. at a stockholders meeting held in Chicago, May 28. There is no change of management, ownership or personnel.

THE NIAGARA FALLS SMELTING & REFINING CORP., Buffalo, N. Y., has started operation in the first unit of its plants at Buffalo. The company produces brass and bronze ingots and special alloys. Ernest G. Jarvis is vice-president and general manager of the company.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

CHEMICALS. Karachi, India. Purchase and agency.—6973.

CHEMICALS. Buenos Aires, Argentina. Agency.—6997.

CHEMICALS. Geneva, Switzerland. Agency.—6998.

CHEMICALS, HEAVYS DYES, ETC. Wellington, New Zealand. Agency.—6990.

CHROME, OXIDE ANHYDRIDE, CRYSTALLIZED. Christiania, Norway. Purchase.—7029.

CHEMICALS, INDUSTRIAL, for paper, rubber, textile, soap and tanning. Milan, Italy. Agency.—7039.

PITCH AND ANTHRACENE OIL. Paris, France. Purchase.—7017.

VARNISHES. Geneva, Switzerland. Agency.—6998.

PLASTERS, RUBBER AND ZINC OXIDE. Stockholm, Sweden. Purchase.—6971.

LARD, PURE. Boulogne-sur-Mer, France. Purchase.—7031.

SOAP. Cape Town, South Africa. Purchase.—6976.

New Companies

FLORIDA PAPER MILLS CO., Leesburg, Fla.; paper products; $500,000. Incorporators: W. S. McClelland and Charles E. Daniell, both of Leesburg.

CALIFORNIA CHEMICAL CORP., 155 East Superior St., Chicago, Ill.; chemicals and chemical byproducts; 1,000 shares of stock, no par value. Incorporators: S. H. Howes, E. C. Tourje and F. S. Barrows.

THOMAS OIL BYPRODUCTS CO., East Orange, N. J.; refined oils and byproducts; $75,000. Incorporators: Harry H. Thomas, George L. McCloud and Charles O. Geyer. Representative: New Jersey Registration & Trust Co., 525 Main St., East Orange.

TWINKLE POLISH CORP., Brooklyn, N. Y.; polishes and kindred products; $10,000. Incorporators: S. Goldberg and O. Chernoff. Representative: Nahum Greenberg, 149 East Broadway, New York.

PITTSBURGH POWDER & SUPPLY CO., Pittsburgh, Pa.; powder, explosives, etc.; $25,000 John B. Nicklas, Jr., 5531 Jackson St., Pittsburgh, is treasurer.

MISSOURI HIGH GLOSS VARNISH CO., St. Louis, Mo.; varnishes, stains, etc.; $50,000. Incorporators: W. W. Sanders, H. S. Eddie and C. A. Neil all of St. Louis.

AURORA PAPER PRODUCTS CO., Hackensack, N. J.; paper products; $250,000. Incorporators: Carl M. Legg, William R. Sommer and Cornelius Kerkhof, 43 State St., Hackensack. The last noted is representative.

UNION CHEMICAL CO., Wilmington, Del.; chemicals, fertilizers, etc.; $100,000. Representative: Franklin L. Mettler, 832 Market St., Wilmington.

SUPERIOR WAX CO., East Cass St., R. F. D., Joliet, Ill.; waxes and refined petroleum products; $10,000. Incorporators: Thomas P. Feely, George J. Lowrey and Fred H. Yaley.

MONONGAHELA CHINA & MFG. CO., Mannington, W. Va.; chainaware and ceramic products; $200,000. Incorporators: A. B. Joliffe, F. W. Vance and William F. Staggers, all of Mannington.

MARSTIN ADHESIVE CO., Boston, Mass.; paste, adhesive products, etc.; $100,000. Clayton R. Marstin, Braintree, Mass., is treasurer and representative.

CASPARD LUBRICANTS, INC., New York, N. Y.; oils, greases, etc.; $50,000. Incorporators: W. E. Townsend, H. W. Ahlstrom and A. B. Root. Representative: Harrington & Cusack, 15 West 44th St., New York.

EVERHOT CHEMICAL CO., Newark, N. J.; chemicals and compounds, etc.; $250,000. Incorporators: Arthur W. Herrigel, Leo J. Wertheimer and W. T. Vanderlipp, 790 Broad St., Newark. The last noted is representative.

CENTRAL CARBON CO., INC., Monroe, La.; carbon black and affiliated products; $625,000. Incorporators: C. E. Slagle and R. Downs, Jr., both of Monroe.

GEORGE S. BIGELOW VARNISH CO., 1502 Monadnock Block, Chicago, Ill.; varnish, paints, etc.; 250 shares of stock, no par value. Incorporators: George S. Bigelow, George R. Jenkins and Edwin A. Munger.

KAUFMAN & MACKLIN, INC., New York, N. Y.; alloys, compounds, etc.; $25,000. Incorporators: M. Kaufman, M. L. Macklin and J. Fox. Representative: Louis Muraskin, 63 Park Row, New York.

MO-GRITE OIL CO., Tulsa, Okla.; petroleum products; $100,000. Incorporators: T. J. Chastain, Tulsa; and S. L. and R. M. Chastain, Wichita, Kan.

KUM-KLEEN PRODUCTS CO., Pittsburgh, Pa.; polishing compounds, chemical specialties, etc.; $75,000. Incorporators: W. G. Ossman, H. R. Mason and B. B. Marpeny. Representative: Capital Trust Co. of Delaware, Dover, Del.

SIBYL K. SHAWN CORP., Troy, N. Y.; chemicals and affiliated products; $100,000. Incorporators: S. K. Shawn, D. Gerhardt and A. Kapp. Representative: H. J. Crawford, Albany, N. Y.

LITEMETAL CASTING CORP., Trenton, N. J.; brass and other metal castings; $125,000. Incorporators: William Watson, Fred F. Roberts and Richard R. Watson. Representative: Alexander Budson, 806 American Mechanic Bldg., Trenton.

COMMERICAL OIL CO., 4,600 Ferdinand St., Chicago, Ill.; refined oils; $50,000. Incorporators: Raymond I. Pane, Albert T. Kramer and John W. Bolland.

W. E. FROST PAINT CO., Palm Beach, Fla.; paints, varnishes, etc.; $20,000. W. E. Frost, Palm Beach, is president and treasurer.